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DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1987

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE

COMMITTEE ON APPROPRIATIONS

UNITED STATES SENATE

NINETY-NINTH CONGRESS

SECOND SESSION

ON

S. 2827

A BILL MAKING APPROPRIATIONS FOR THE DEPARTMENT OF DEFENSE FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1987, AND FOR OTHER PURPOSES

PART 2—(Pages 1-325)

Navy Aircraft Procurement and
Related Research and Development
Strategic Defense Initiative
Strategic Programs

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CONTENTS

WEDNESDAY, MARCH 5, 1986

Strategic Defense Initiative

Department of Defense: Page

Strategic Defense Initiative Organization 1

WEDNESDAY, APRIL 9, 1986

Strategic Defense Initiative

Department of Defense:

Strategic Defense Initiative Organization 61

THURSDAY, APRIL 10, 1986

Strategic Defense Initiative

Nondepartmental witnesses:

Former Secretary of Defense McNamara 113

Former Secretary of Defense Brown 141

WEDNESDAY, APRIL 23, 1986

Navy Aircraft Procurement and Related Research and Development

Department of Defense:

Department of the Navy 185

U.S. Marine Corps 196

THURSDAY, MAY 8, 1986

Strategic Programs

Department of Defense:

Department of the Navy 227

Department of the Air Force 234

FRIDAY, MAY 9, 1986

Strategic Defense Initiative

Nondepartmental witnesses:

Dr. Edward Teller 291

Dr. Martin J. Hoffert 313

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1987

WEDNESDAY, MARCH 5, 1986

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 10:15 a.m., in room SD–192, Dirksen Senate Office Building, Hon. Ted Stevens (chairman) presiding.

Present: Senators Stevens, McClure, Andrews, D'Amato, Rudman, Cochran, Proxmire, Hollings, Johnston, Byrd, and Sasser.

DEPARTMENT OF DEFENSE

STRATEGIC DEFENSE INITIATIVE ORGANIZATION

STATEMENT OF LT. GEN. JAMES ABRAHAMSON, DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

STRATEGIC DEFENSE INITIATIVE

OPENING STATEMENT OF SENATOR STEVENS

Senator STEVENS. Good morning. Gentlemen, I apologize. I was trying to see if we could get consensus about mailing problems in the Senate, but so far, no, we have not.

We are here today to review the fiscal year 1987 request for the Strategic Defense Initiative. The administration's request of $4.8 billion is $2 billion more than the fiscal year 1986 appropriation of $2.75 billion. SDI was exempted from any reductions under provisions of Gramm-Rudman.

SDI now comprises 8.2 percent of the fiscal year 1986 research and development budget. The proposed fiscal year 1987 budget increases SDI to 11.5 percent of all defensewide RDT&E and is growing in the future. In relation to total defense, the SDI budget comprises 1.5 percent of all defense spending requested.

FORMATION OF SDI

In March 1983, President Reagan announced the formation of the Strategic Defense Initiative. SDI was not a new start, but a consolidation of all ongoing research in the field of ballistic missile defense and strategic defense previously managed by military services and defense agencies.

However, with the formation of SDI, the level of effort into the field of strategic defense has risen sharply. Funding for SDI-related programs has risen from $1 billion in 1984 to $4.8 billion in the current request.

HEARING PROCEDURES

This will be the first of a series of hearings we will conduct on the Strategic Defense Initiative. This first hearing will be an overview of the major programs in the request, the new directions given to the program since last year and the ability of SDIO to execute the growing research program in an efficient manner.

On April 9 we will conduct a closed hearing on SDI to go into greater technical detail on some of the programs we will discuss here today. That will prevent us having any suggestion that we might close this hearing.

We have scheduled open hearings for April 10 and 11, to discuss the policy and technical aspects of SDI with outside witnesses of both sides of the issue. It may be necessary to go back into a further hearing after that to have some of the issues that are raised there discussed by General Abrahamson and his people.

We have with us today to discuss the President's fiscal year 1987 budget request for SDI the Director of the Strategic Defense Initiative Organization, Lt. Gen. James Abrahamson.

General Abrahamson, welcome back to the subcommittee.

Your entire statement will be placed in the record in full. For the record, we would ask that you submit year-end summaries of SDI obligation and expenditure rates for fiscal year 1985 by program element.

We would also request projections of SDI program obligations and expenditure rates for fiscal years 1986 and 1987.

HEARING PROCEDURE

I might say that we had a conference this morning before the session and that is why we were late. We will follow our normal procedure and, General, we are going on a basis here in the committee of a 10-minute allocation to each member in accordance with the time he came into the room.

Under those circumstances, I would ask you to remember that we have a 10-minute limitation. Try to keep your responses and those of whom you might call to assist you to a minimum amount so that we can proceed in this orderly way.

We have the order in which people have come into the room. Obviously, I am last, so keep your answers to these other guys short so that I can get in some questions.

PREPARED STATEMENT OF SENATOR D'AMATO

Senator D'Amato has requested that his prepared remarks be placed in the record. They will be inserted at this point.

[The statement follows:]

PREPARED STATEMENT OF HON. ALFONSE D'AMATO

U.S. SENATOR FROM NEW YORK

Mr. Chairman, I thank General Abrahamson for coming to testify before this committee and for agreeing to more in-depth hearings on the Strategic Defense Initiative next month.

In an austere fiscal year, the Strategic Defense Initiative has received special budget consideration. The administration not only shielded SDI from Gramm-Rudman-Hollings budget reductions in fiscal year 1986, but also has requested an increase from $2.75 billion in this fiscal year to $4.8 billion for fiscal year 1987. This represents the lion's share of increases for all Defense RDT&E programs.

I have been a supporter of the Strategic Defense Initiative since the President went before a national audience 3 years ago to introduce this new research program. SDI continues to be an intensive research program focused on advanced defensive technologies with the goal of the eventual elimination of the threat posed by nuclear armed ballistic missiles and the aim of lessening the probability of nuclear war. Our national security depends upon our ability to stay technologically ahead of the U.S.S.R. Although the United States cannot produce weaponry on the massive scale as the Soviet Union, we do continue to have a technological edge. SDI exploits this advantage.

It is not only taking advantage of our technological advantage that makes SDI research important. The Soviet Union is very active in this area of research. As noted in General Abrahamson's statement, the Soviet Union has the world's only operational antisatellite capability, as well as the only operational antiballistic missile system. The U.S.S.R. is actively developing and modernizing its defenses, including air defense and surface-to-air missiles. The Soviet Union now has a clear advantage in strategic defense that offers Moscow an increasing ability to respond effectively to the retaliatory forces of our Nation and our allies.

The SDI program is a prudent response to a very active Soviet research and development program. The United States pursuit of SDI does not, and will not, violate our treaty obligations. The ABM treaty permits the kind of research envisioned under SDI. The question to proceed to deployment of an actual ballistic missile defense system will not arise for several years, and only after SDI research has determined that such defenses are both feasible and affordable.

Our Nation needs the Strategic Defense Initiative. Research must continue as planned. There are many important indirect benefits of SDI that must be remembered. Our space research in the early 1960's led not only to a lunar landing, but also to hundreds of new technological developments. I expect SDI research will lead to new technological discoveries which will greatly enhance our industrial productivity and improve our standard of living.

I commend the fine work you have done thus far, General Abrahamson, on the President's Strategic Defense Initiative. Such a program with a large price tag and high visibility needs a tireless and dedicated advocate like yourself. I look forward to working with you on this important initiative.

Thank you, Mr. Chairman.

SLIDE PRESENTATION

Senator STEVENS. I see that by virtue of the way the screen has been set up here, we have blocked off my friends at the press table. Is there any way that can be changed? Why cannot we have this thing back in the corner like we did before? Can we do that.

We have a show and tell. Is there some way to put it back in the corner? Where is that slide coming from? Is it coming from behind the equipment? Why cannot it be back in the corner so that we can all see it.

Senator JOHNSTON. The press can come kneel in front of us.

[Laughter.]

Senator STEVENS. I am not going to identify who said that for the press. The other day we had a similar circumstance. They shifted the screen.

Is this in your statement, General?

General ABRAHAMSON. I am presenting my statement for the record. I will not even read excerpts of the statement. I believe that with the aid of the Vugraphs, I can present a better overall picture so that there is an easier understanding.

Senator STEVENS. The difficulty is that we have people who come to see it and the press would like to see it. That means we only see it. I think that is not proper.

Can we shift that somehow? Can we stand at ease here and go off the record and see if it is possible? If it is not possible, we will have to apologize. If it is possible, I think it should happen.

[Off the record]

Senator STEVENS. I yield to Senator Proxmire for an opening statement.

STATEMENT OF SENATOR PROXMIRE

Senator PROXMIRE. General Abrahamson, I deeply appreciate your appearing before the subcommittee today to speak on what has become the Defense Department's highest priority.

As the Chairman has stated, we will have four subcommittee hearings this year on the Strategic Defense Initiative, which I commend him for setting up.

Indeed, SDI needs close scrutiny this year. As we enter the era of Gramm-Rudman budget cuts, it is almost a certainty that the fiscal year 1987 Defense budget will at least be frozen at last year's level. That is why any budget that increases by a whopping 74 percent, as you propose to do with SDI, deserves very special scrutiny.

So far the SDI budget has tripled since 1984. And now the administration wants that budget to quadruple over a 4-year period.

So, it is time for Congress and the public to take a long hard look at Star Wars and what it is costing us.

CLASSIFICATION OF GAO REPORT

For that reason, I am deeply troubled by a recent decision by the Strategic Defense Initiative Office to classify a General Accounting Office report that would have given Congress and the public a clearer picture of how tax dollars are being spent on Star Wars.

Now, let me say right off the bat that I am not in favor of making public real classified information that might aid the Soviets. In fact, this Senator has been the first to criticize President Reagan's proposal to share our Star Wars' secrets with the Soviet Union.

But in this case it seems that SDI is more concerned about Congress and the public finding out what is going on in this program than the Soviets.

This GAO report, as you know, was requested by four members of this subcommittee: Senator Chiles, Senator Johnston, Senator Andrews, and myself. We requested that GAO compile a very simple guide that would give Congress and the public a better understanding of the SDI organization, its financial structure, and its programs.

On January 10, GAO submitted its report to SDI for its review.

SDI then sat on the report for more than a month. Finally, on February 14, we were informed that SDI had classified the report.

I am mystified by this classification because GAO tells me that it compiled the report entirely from unclassified sources. For example, the computerized data your office gave GAO on the program's work package directives were unclassified.

What is more, the information in the GAO report is almost identical to the information you made public last year in your unclassified report to the Congress on the Strategic Defense Initiative for 1985.

In fact, the only difference between the GAO report and last year's report seems to be that GAO updates last year's information.

That is not all. For $145 you can buy on the open market a 444-page detailed "Guide to the Strategic Defense Initiative," and for $480 you can buy a 200-page "Strategic Defense Initiative Market Directory," both of which were compiled with SDI information made public and both of which seem to have as much detail as the GAO report.

My office has been told that SDI agrees that the GAO report was compiled from unclassified information, but that it was classified because of all this information being pieced together in a comprehensible way.

I guess this supposes that the Soviets do not have access to a pocket calculator and $625.

Next I heard in press reports that the reason this report was classified was that SDI did not want Soviet agents targeting defense contractors doing Star Wars' work.

If that is the case, then why did SDI last fall release to the public and press a 28-page detailed list of all its contractors and their funding levels?

It seems awfully strange to me that last year the SDI could not wait to declassify certain experiments in order to get them on the network news so they could build public support for the program.

But now when Congress asks for a complete picture of how the public's money is being spent in this program, SDI is quick to put a security clamp on it.

The question I have is: Does this classification of the GAO report represent the first step of SDI pulling back its program from congressional and public scrutiny.

If it is and if you expect Congress to increase your budget by 75 percent with blinders on, I think you are in for a rude awakening.

Thank you, Mr. Chairman.

Senator STEVENS. Obviously, there is not complete unanimity on this subcommittee on this project, General. You will have a nice cool morning this morning.

I yield to my friend from Wisconsin for questions.

Senator PROXMIRE. I think Senator Byrd was ahead of me.

Senator STEVENS. Do you want to do your show and tell first? I would like to see that. Let us do that before I yield.

General ABRAHAMSON. Since that was in the form of a question, would it be reasonable to answer Senator Proxmire at this point or not?

VUGRAPH PRESENTATION

Senator STEVENS. Each member will have his time after you show the rest of us these slides.

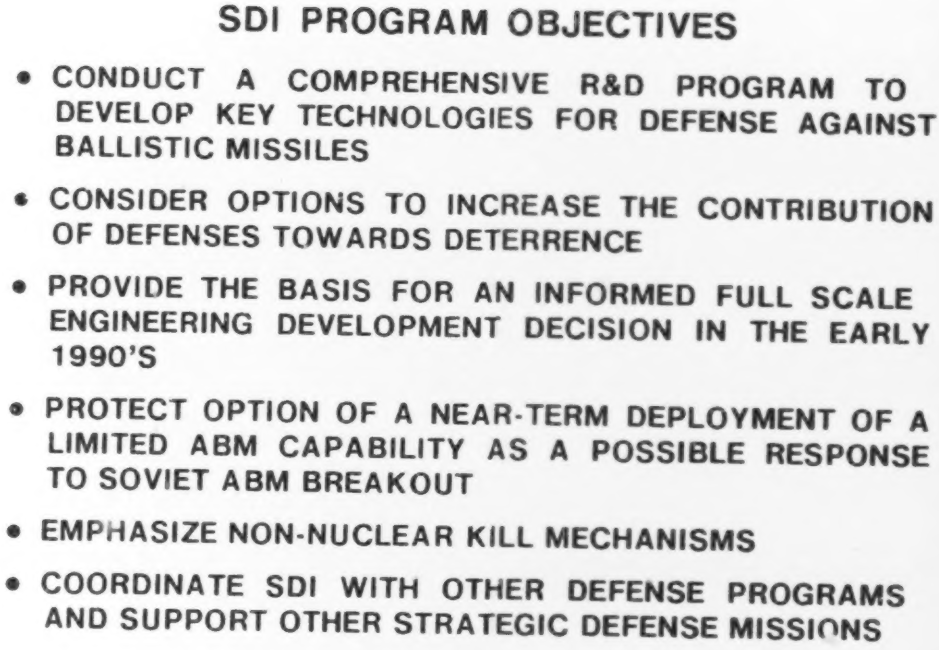
General ABRAHAMSON. I do have a written, completely unclassified, overall discussion of the testimony that I think is important to have on the record in addition to the briefing and the briefing slides.

Senator STEVENS. Each member has one. It is available to the press. We appreciate the fact that it is unclassified.

General ABRAHAMSON. It does summarize several important points about the program that can better be illustrated in the briefing, but it is written and available in that sense.

It does go back and review in a brief form what the Soviets are doing in similar technology areas. It does lay out the essential facts of our performance last year and the first year of the program in terms of obligations and expenditures.

It does lay out the fundamental structure and some of the progress that we have made in the program in a brief way. I do believe that in terms of the charts that I can illustrate that in more detail. Therefore, I submit this for the record and I would like to proceed with the briefing.



SDI PROGRAM OBJECTIVES

- CONDUCT A COMPREHENSIVE R&D PROGRAM TO DEVELOP KEY TECHNOLOGIES FOR DEFENSE AGAINST BALLISTIC MISSILES
- CONSIDER OPTIONS TO INCREASE THE CONTRIBUTION OF DEFENSES TOWARDS DETERRENCE
- PROVIDE THE BASIS FOR AN INFORMED FULL SCALE ENGINEERING DEVELOPMENT DECISION IN THE EARLY 1990'S
- PROTECT OPTION OF A NEAR-TERM DEPLOYMENT OF A LIMITED ABM CAPABILITY AS A POSSIBLE RESPONSE TO SOVIET ABM BREAKOUT
- EMPHASIZE NON-NUCLEAR KILL MECHANISMS
- COORDINATE SDI WITH OTHER DEFENSE PROGRAMS AND SUPPORT OTHER STRATEGIC DEFENSE MISSIONS

VUGRAPH 1

SDI OBJECTIVES

General ABRAHAMSON. First of all, I would like to emphasize that there are no changes in the program. I say this because last year there were a great number of different ideas about what the SDI is and what our clear objectives were.

Our objectives have not deviated from the direction set forth by the President in the very beginning of the program. The President asked that we conduct a research program with the very lofty aim of negating essentially the effect of nuclear ballistic missiles and to increase the contributions of defense, in general, to United States and allied security.

That means that there are some specific objectives. Again, I would like to point out that we are still at the first bullet, we are dealing with a research program at this point.

Now, a research program has many, many dimensions. You will see that as we go forward with the briefing. In some cases it is scientific research, in many cases it is research on the ways to reduce cost, so someday there may be an affordable option.

The key is the third bullet down where we are aiming at a decision that certainly a future administration—the President, Members of Congress, and the Pentagon—will have to make. Now, this will be an extremely complex decision.

Therefore, we feel that in order to have sufficient information to make an intelligent decision, to understand what the costs will be, the most vital time to be investing in technology is now in the research phase of the program. Sound research investments will provide the confidence necessary to reach this decision in the future.

I think that it is very clear that we are aiming the research program at this decision point. Until that time, we are conducting the program within the limits of the ABM Treaty, within the narrow interpretation as is the President's policy. This is reviewed very, very carefully at many levels, in an unclassified and classified form, which is made available to the Congress. In that way, it is open to congressional scrutiny.

NONNUCLEAR KILL MECHANISMS

We are emphasizing nonnuclear kill mechanisms. However, there is an important reason why the Department of Energy [DOE] under their appropriations is properly investigating the potential of some of the advanced technologies that use nuclear systems to drive advanced lasers or other advanced concepts.

We are concerned about the potential of nuclear driven systems for several reasons. One is that we would like to know if this can be used against not only a future SDI, but any of our systems.

We are particularly concerned about the potential of nuclear driven systems in Soviet hands.

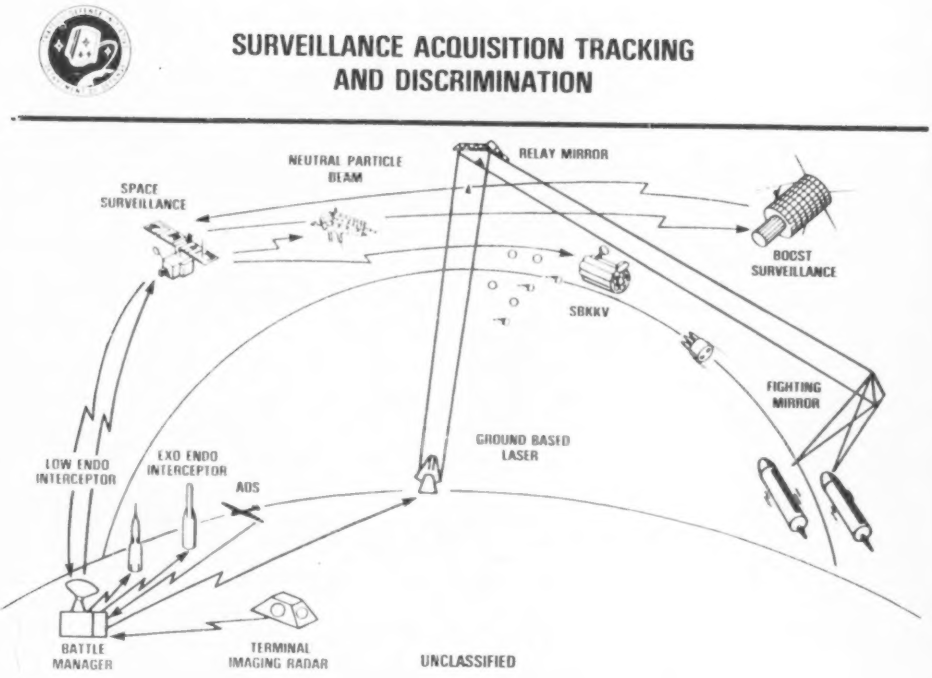
Reference to the x-ray laser first appeared in Soviet literature in the late 1960's. Since that time, the concept of the x-ray laser has been pushed by our people and has been creatively brought forward by some of the scientists in the U.S. Department of Energy. Again, I would like to state, the reason that we are following this concept is first, to see what it could mean in Soviet hands and second, to evaluate its potential.

It does not mean that we are making a decision that is different from what the President's emphasis on nonnuclear technology. By far, the great majority of the money is absolutely nonnuclear.

We do spend a great deal of our time and effort to ensure that there is no overlap between our budget and the other research budgets of the Services. I will give you some examples of that. Research budgets are very carefully scrubbed to ensure that in areas where we have research that contribute to conventional defense.

You will see examples of that and I will mention that as we go further. It is quite clear that very large chunks of the research program that we are conducting, has a much broader application than to ballistic missile defense alone. Some of the research we are conducting is not funded in any other place in the Department of Defense request.

Now, when we try to describe this broad system and, I might add we have had a great deal of difficulty in the past, because many people have seen just our cartoons of how one tries to assemble a layered defense. I have tried a way that I think characterizes it more fully.



SURVEILLANCE ACQUISITION TRACKING AND DISCRIMINATION

NEUTRAL PARTICLE BEAM
RELAY MIRROR
SPACE SURVEILLANCE
BOOST SURVEILLANCE
SBKKV
FIGHTING MIRROR
GROUND BASED LASER
LOW ENDO INTERCEPTOR
EXO ENDO INTERCEPTOR
ADS
BATTLE MANAGER
TERMINAL IMAGING RADAR
UNCLASSIFIED

VUGRAPH 2

SURVEILLANCE INVESTMENT

If you look on the upper left-hand side, a very significant portion of the investment, and it is an investment, is going into eyes for the system, not into weapons at all. These eyes are important not just for SDI, but for many systems. I will point those out as well.

So, think of the investment in surveillance and each of the functions as being a very important element that would make the weapons work and absolutely fundamental.

Now, there are some requirements that an SDI system has that will go beyond what we need today. For example, just attack and warning, and I will illustrate that.

In the lower left corner are the brains of the system, highly automated, but still someday if fully implemented, there may be a way that human beings could maintain control and ensure reliability over the automated elements of the system. It is very important that in our research phase we do a great deal of simulation because any proposed SDI system would be highly distributed.

Finally, the last element and the one that seems to get the most attention everywhere, the weapons side of it. They are optimized to be anti-weapons as opposed to offensive weapons as characterized by the Soviets in some of their propaganda and by some of our critics.

Now, let me spend just a minute on the defensive system. Again, you will begin to see why it is that the request begins to go up so dramatically and why it is such a large request. There are a number of systems that are all required in order to make such a defensive capability operate in the future.

BOOST SURVEILLANCE SYSTEM

Let us take the one on your upper right-hand corner called the Boost Surveillance System. Today we do have boost surveillance. We have a set of satellites that have been serving the Nation well by providing warning against a Soviet attack.

Of course, the President can do nothing except get the bombers off, but he cannot stop any ballistic missile today. That system is an older system. It has been examined and there are clear requirements to upgrade, to modernize, and, hopefully, to make it less expensive in the future.

OPERATIONAL REQUIREMENT

There is a clear operational requirement. Part of the U.S. Air Force operational requirement is for a follow-on to the Defense Support Program [DSP]. What's interesting is that all of the research and development funding for that follow-on and modernization effort is in the SDI program.

The Air Force is not funding an additional development program for a DSP follow-on. The DSP is a clear example of why we have dual activity. In this case it is between the Air Force and the SDI.

The question now is, Why is it in SDI? Well, the answer is it is in SDI because we have program requirements that go beyond those of just a DSP, data handling requirements. We have to be more accurate because, after all, for warning, all we have to do is to be able to see that there are a large number of missiles and, hopefully, to see the general direction from which they are coming.

For the SDI, we would have to be able to focus in very, very closely so that you can begin to target weapons against those systems.

Now, here is a clear case of an operational requirement funded only in DSP. The others are not quite that clear. I would like to point out that the development of that program would be a multi-billion-dollar effort in the future.

REDUCING SYSTEM COSTS

When you look at the wedge of funding that goes out in SDI for any satellite program, it is an expensive development effort. We are doing research as opposed to development for that program.

One of our primary objectives is to try to bring the cost of that system down so that when a development decision is made—at that point it would probably be funded at least partially by the appropriate service, in this case the Air Force—then we will benefit as taxpayers.

But that is only one of the surveillance systems that would have to operate in a ballistic missile defense system. We cannot be satisfied with merely seeing rockets as they come. We need to be able to tell the difference between decoys and warheads on the way.

STEP UP IN CAPABILITY

Now, that means another step up in capability, a very difficult step, and we are looking at two fundamentally different approaches to that. But we think we will need both of them in order to be complementary.

At the time of the Fletcher Commission, people felt we could do this purely with passive means, using heat-seeking sensors that would look out and be able to look accurately enough so that you could tell a decoy from a warhead.

USE OF DECOYS

Now, that will work for today's decoys but maybe not for the future, so we are doing very serious simulations with our countermeasures "red team." In red team exercises, we are building American versions of Soviet warheads and testing what they look like. We are also building American versions of future Soviet decoys in order to understand what decoys they might use. Out of that red team effort, we are coming to the conclusion that passive detection and decisionmaking is not quite sufficient, that we may in the end require interactive decisionmaking.

NEUTRAL PARTICLE BEAM

In other words, we need some way to probe those decoys and to tell the difference. One of the methods is the other item that is in green called the neutral particle beam. This is only one technique. Actually there are several techniques available to us. We would not need a large number of those.

Before when I have talked about a neutral particle beam, I have talked about it in a context of a very potent weapon and it can be a very potent weapon, but at lower power levels it can be used, and we have clear tests that show us now, it can be used to reach out and to probe some future threat cloud, of some hundreds of thousands of objects, and with very cheap detectors be able to get a return signal that comes back from this neutral particle beam.

The return signal would tell us which are decoys and which are warheads. That is what we mean by active or interactive discrimination. Obviously, a final decision on that technique versus some others is a little premature, but I would like to point out that we are working in these areas and that means more research at this point in time because we are funding two very important projects.

INFRARED SURVEILLANCE

Now, the infrared surveillance, the satellite on the left, would probably be a lower altitude satellite. I would like to spend just a minute on this to show you how it is that we have tried to absorb the budget cuts in the past so that you can understand that we do recognize that we are all in a constrained budget situation and we are trying to find ways to conduct the research so that it will be meaningful so that that future decision can be made.

But, nonetheless, it can also be done as prudently and as inexpensively as possible. The earlier plan for that satellite development was to develop an experimental version of that satellite and to put it in space. Now, that costs a lot of money and, frankly, it takes more time than I wanted to expend.

SATELLITE DEVELOPMENT PROGRAM

We spent a lot of time working with contractors, and working in-house examining a better way, a less expensive way, to conduct the satellite development program. What we are doing is splitting it into two pieces. One piece will never be launched in space—the simulation on the ground of the very difficult data handling problem, the computer problem.

We do not have to put that in space in order to understand whether or not that will work. We can use simulators on a much more cost-effective basis.

SENSOR TESTING

However, some of the eyes of that particular sensor, the infrared or heat-seeking eyes or maybe other parts of the spectrum as well, you have to be able to look out and see whether the sensors really perform in space and against the background of the Earth.

Therefore, there will be one or perhaps several inexpensive experiments in space to test the sensor. You do not need to do all the rest in space, too. That is an example of how we are trying to bring the cost of the program down and still obtain meaningful information for the decision point in the future. At the same time we must be able to ensure that we can make that decision with confidence.

Those are three satellite systems and that takes a great deal of investment to be able to do that research.

F-16 AIRCRAFT DEVELOPMENT

I was responsible for the F-16 and I can tell you that the reason that the F-16 is a much lower cost fighter than some of the others that we developed is because early technology investments were available. It is also because early decisions to structure that fighter brain as a lightweight fighter and to try to use advanced avionics for additional capability so that it would be a meaningful warplane and add to our Air Force inventory as a useful deterrent were made.

The dollars spent early in the research program, if they are accompanied by meaningful decisions early in that program, will have a great deal to do with how affordable a follow-on system will be.

So, even though I know in this very difficult time of allocating national resources that we are asking for a great deal of money, it is an investment and that investment will swing a tremendous savings out in the future should the program go ahead.

FURTHER SENSOR DEVELOPMENT

Now, there are still additional sensors that are required and those are required for some of the more traditional kinds of systems that would make up the last layers of a multitiered ballistic missile defense. We have been doing very effective work on traditional radars and on an airborne optical adjunct. We need to be sure that that radar can work in all kinds of environments including a very effective nuclear environment under the conditions of a nuclear attack.

We would like to be able to carry out each function in more than one way. The Soviets will be clever. Therefore, we need to understand in our research program that we are not just working off where they might go in the next year or two or what our intelligence says they might develop, but we would like to be able to understand the fundamental physics of the exchange on both sides—the engineering advantages, or the fundamental cost advantages. We are searching for answers on these very fundamental areas.

That is how we believe, when we find the ones that are clearly on the side of defense, that we can make a responsible recommendation to a future Congress and administration whether or not to develop and deploy a strategic defense system.

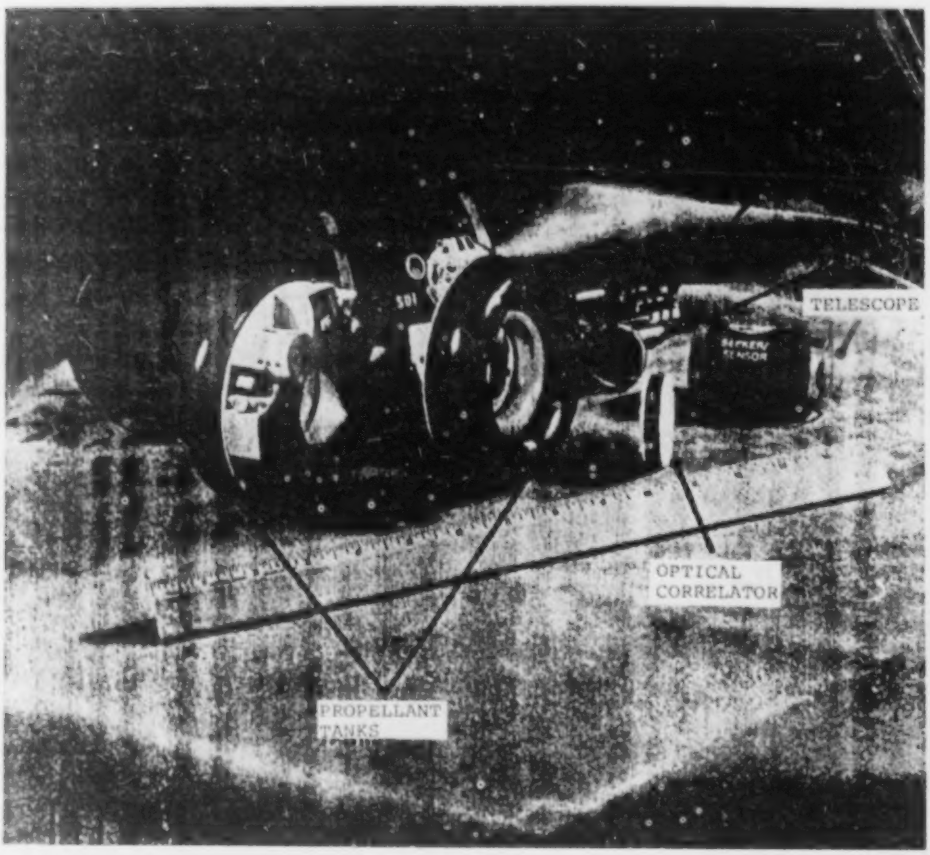
Again, it takes money while we are searching for these fundamental answers. I will comment on that when I get to some of the laser portions and try to get that across in a more graphic way.

COMMUNICATION LINKS

Now, I indicated the brains of the system are very, very critical. It will be highly distributed. All those links are communications links. They may be laser communications links so that they cannot be jammed and that would be very private, but that requires investment in laser communications where we are today.

Investment in laser communications will have a profound effect on many of our military systems well beyond SDI. It also will look at frequency ranges way up in what we call the 60 gigahertz band width where it cannot penetrate the atmosphere and where the Soviets would then have a very difficult time beginning to jam and work with the system.

So we are doing fundamental research on the cost and the way in which we should build systems for that in the future. I will give you an example of some of the smaller research programs.



VUGRAPH 3

RADAR FREQUENCY FOR TERMINAL IMAGING RADAR

This chart shows an example of the first time we produced something that will substitute for traveling wave tube, solid state physics in a transmitter tube in a radar frequency, in this case radar frequency for the terminal imaging radar.

The emphasis we are making in building this particular circuit is so that someday we can build that terminal imaging radar so that it will be reliable and cost effective. In this case, we are examining how one produces this kind of thing, for instance, we need to know what kind of quality assurance techniques can be used for solid state radar systems so that we can be assured of high quality. As an example, the terminal imaging radar should be reliable so we can purchase them at a reasonable price in the future.

In this way when the time for a decision comes, we will be able to give you reasonable cost estimates. I believe it is very legitimate to ask how much a system will cost in the future. I have to say I cannot give you a responsible answer yet. It depends on the amount of investment we can make in the research program and certainly the result of that research program.

WEAPONRY

At the time of the Fletcher report, which was quite early in this whole process, there was a great focus on the weapons that can be used and used effectively to destroy ballistic missiles. Obviously, people were looking for huge advantages.

This is one of the reasons that there was this great emphasis on laser systems, speed of light type of weapon. There were others that were examined. One of the ways that I absorbed the $1 billion cut last year and what amounts to a 25-percent cut from what our request was in the first 2 years and tried to do it in a way that minimized the impact of those cuts was to change the fundamental philosophy of the research program.

LASER CONCEPTS

At the time of the Fletcher report people envisioned that we would examine many different kinds of laser concepts. We would take all of those to the level of maturity so that we could then begin to make decisions between them.

Now, that is an assumption that one has the money and the time to be able to examine each of these various laser concepts and I can assure you there is a large number. You had to make difficult choices in the budget and the Department of Defense had to make difficult choices in the budget.

I felt that I would not be doing my job responsibly if I did not also make choices within whatever Congress allocated to the program. So, instead of going forward with a large number of programs and just accepting a schedule slip, what I have done is make a series of decisions between potential concepts.

GROUND-BASED LASERS

By doing that, I have kept some of them, and I will point out the ground-based lasers [GBL] as one of the important exotic ones, in what I call "after-burner." We are really trying to get GBL going because the technical promise is there. The promise of being able someday to destroy boosters perhaps at the rate of three, four, five per second and that is the kind of goals that we are looking at.

On the other hand, I have either eliminated or cut way back on other programs. Now, I have not eliminated all research in all areas of other competing laser activities, but I have certainly slowed it down dramatically. That is with a profound sense of technical regret because there are teams of people and more importantly there are ideas there that may make some of those things cost effective, that may change the situation as it looks today.

But I felt that I had to make the choices and, therefore, that is the way we have absorbed a substantial amount of the budget cutting. You will see that later on when I give you some actual numbers.

So, now the weapons are really focused down to several types, a ground-based laser as our principal directed energy concept for boost phase, directed energy concept—remember, I said we do not want to use any one technique that the Soviets could easily counter.

So, what I have added is work which is very successful and really not as complicated as some of the laser work in a space-based kinetic kill vehicle. That is a lot of technical terminology, but it really is a kind of simple rocket pod in the sky with a very, very fast missile.

That very fast missile will allow us to put fewer of those rocket pods up there and still be able to reach out at high speed and destroy boosters at the end of their boost phase.

Now, some people are asking whether a laser can be used for offensive purposes?

There are two contexts in which they propose that, but the worst one and the one that is distorted the most is the perception that it can be used offensively as a weapon of mass destruction.

We can get a laser, if the frequency is correct, up to the atmosphere and if we can get it up, logic follows we can get it down. However, we are not spending money on trying to figure out how to get down to the surface of the Earth with the intensities that you might be able to hurt anybody. Remember that a laser is only putting very intense explosive power, maybe the explosive power of two or three hand grenades, but very intensively placed at exactly the right point.

It would be military nonsense to take a laser and try to destroy a city by marching up and down the different avenues in that city.

Furthermore, lasers cannot penetrate the clouds, although the Soviets are working intensively on that and we are examining it, and if you look at the weather for Moscow and some of the Soviet cities, you will see that that is certainly not a good target for a laser.

Finally, if you look at Moscow in some respects, it is a little bit like Washington. Mostly the buildings are large buildings, huge stone piles, and a laser will not penetrate any of these areas.

SPACE-BASED KINETIC KILL VEHICLE

Let me take the space-based kinetic kill vehicle. If we took the time and trouble to put a very large reentry thermal shield on the front end, yes, you could penetrate the atmosphere and penetrate deeply, but we are not putting any warheads on those and we want to minimize the weight of these systems. We want to fire so fast so that you can cover great ranges.

So that, indeed, what you would do is you would burn up in the upper atmosphere. You would have to select that very carefully so that you can destroy boosters, but you do not want to carry even extra ounces of weight in order to penetrate deeply.

Anyone who examines our program will see that is the way we are proceeding. In fact, that is the way I presented it to the Soviets at the space and defense portion of the Geneva negotiations last fall in an attempt to ensure that they understand our motivation and that we are indeed trying to look at a more stable environment. We are trying to discuss how to produce a stable transition.

EXPLANATION OF SDI TO SOVIETS

Our Ambassador, Max Kampelman, suggested that I officially explain the program to the Soviets as opposed to their getting the data by illegal means or from our press. We also gave them the opportunity to have their questions answered directly, which I did.

Of course, we did not present classified information, the intent was to be as open as possible about the program. Obviously, part of that strategy was then to ask the question, "Will you now explain to us about your program?"

We have not gotten to the point where they are willing to do that. This is a very important point of measurement in terms of the sincerity of their negotiations and when you can really gauge you are making a great deal of progress.

Senator STEVENS. General, we are going to have to cut this down.

General ABRAHAMSON. I would like to go briefly to the cost charts. I will just flash those quickly. Hopefully, on the basis of this, you get a much better understanding of what it is we are trying to do and why it is such a broad effort, what happens in 1986 and what is going on in 1987.

SDI FY 86 BUDGET

[$M]

PROGRAM ELEMENT	FY 86 REQUEST	FY 86 ADJUSTMENT	FY 86 REQUEST
SENSORS	1386.4	-529.4	857.0
DEW	965.4	-121.0	844.4
KEW	859.7	-263.9	595.8
SYSTEMS & BM/C³	243.3	-16.0	227.3
SURV/LETH	258.2	-36.6	221.6
MGT HQ	9.2	+3.9	13.1
TOTAL	3722.2	-963.0	2759.2

VUGRAPH 4

FISCAL 1986 BUDGET

This was in 1986. Here you can see where we took our cuts in order to distribute that nearly billion-dollar cut in the program. As you can see, it is distributed rather evenly except for the expensive sensors part of the program.

I would like to thank not only this committee, but the Congress as a whole for not macromanaging but allowing us the ability to go back and distribute the cuts and distribute them where we felt it would be most effectively placed.

That has allowed us to minimize the impact although you cannot negate it. It would be impossible to take a billion dollars, 25 percent, out of a program without having a very significant impact.

Now, at the next level down you can begin to see how we distributed the cuts across the other parts of the program in a general project-by-project basis. This is quite different than getting down to the very, very specific words.

PROPOSED FY 87 REQUEST

[$M]

PROGRAM ELEMENT	FY 85 BUDGET	FY 86 BUDGET	FY 87 REQUEST
SENSORS	546	857	1263
DEW	376	844	1615
KEW	256	596	991
SYSTEMS & BM/C^3	99	227	462
SURV/LETH	112	222	454
MGT HQ	8	13	17
TOTAL	1397	2759	4802

VUGRAPH 5

FISCAL 1987 BUDGET

In 1987 you can see how we have distributed across the five program element numbers. Now we have the plans in place well enough that I believe we now must recover primarily in the sensor area so that you can see that is a very large buildup area.

The others are buildups as well because there is a great deal of work, fundamental work, that has to be done.

[The statement of General Abrahamson follows:]

STATEMENT ON

THE STRATEGIC DEFENSE INITIATIVE

BY

LIEUTENANT GENERAL JAMES A. ABRAHAMSON
DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

MR. CHAIRMAN IT IS A PLEASURE TO APPEAR BEFORE THE COMMITTEE TO DISCUSS WITH YOU THE STRATEGIC DEFENSE INITIATIVE. THREE YEARS AGO PRESIDENT REAGAN EXPRESSED THE CONVICTION THAT FREE PEOPLE SHOULD LIVE SECURE IN THE KNOWLEDGE THAT THEIR SECURITY DID NOT REST UPON THE THREAT OF RETALIATION TO DETER A SOVIET NUCLEAR ATTACK. AT THAT TIME HE DESCRIBED THE THREAT POSED BY INCREASING SOVIET NUCLEAR ARSENALS, AND HE PROPOSED BOLD STEPS, EMBODIED IN A NEW INITIATIVE, TO ADDRESS THAT THREAT. THIS INITIATIVE CALLED FOR A COMPREHENSIVE AND INTENSIVE RESEARCH PROGRAM TO PURSUE THE ADVANCES IN TECHNOLOGY THAT HAVE THE POTENTIAL FOR STRENGTHENING DETERRENCE BY INTRODUCING A DEFENSIVE COMPONENT TO OUR DETERRENT POSTURE.

I BELIEVE IT IS IMPORTANT TO REITERATE THE PROGRAM GOALS AND OBJECTIVES AS WE MOVE INTO OUR THIRD YEAR. THE GOAL OF THE STRATEGIC DEFENSE INITIATIVE IS TO CONDUCT A VIGOROUS PROGRAM OF RESEARCH ON EMERGING TECHNOLOGIES IN SEARCH OF A BETTER BASIS FOR A CREDIBLE DETERRENCE AND STRENGTHEN THE STABILITY OF PEACE THROUGH STRATEGIC DEFENSE. WE ENVISION THAT SUCH A PURSUIT WILL

OFFER INCENTIVES TO THE SOVIET UNION TO JOIN WITH US TO REDUCE SIGNIFICANTLY OR EVEN ELIMINATE BALLISTIC MISSILE FORCES. WITH THIS GOAL AS A GUIDE FOR THE PROGRAM LET ME DESCRIBE FOR YOU THE PROGRESS AND STATUS OF THE SDI AS WE BEGIN OUR THIRD YEAR OF THE PROGRAM.

IT IS NECESSARY TO SPEND A SHORT TIME DISCUSSING THE SOVIET EFFORTS IN OFFENSIVE SYSTEMS BECAUSE CERTAIN POINTS BEAR REPEATING. SINCE 1969 WHEN THE SALT I PROCESS WAS JUST STARTING THE SOVIET UNION HAS BUILT FIVE NEW CLASSES OF INTERCONTINENTAL BALLISTIC MISSILES AND UPGRADED THESE EIGHT TIMES. AS A RESULT, THEIR MISSILES ARE MUCH MORE POWERFUL AND ACCURATE THAN THEY WERE SEVERAL YEARS AGO. THE UNITED STATES, IN CONTRAST, INTRODUCED ITS LAST NEW INTERCONTINENTAL BALLISTIC MISSILE, THE MINUTEMAN III, IN 1969, WHICH HAS BEEN UPGRADED ONCE. IN ADDITION, WE ARE NOW WORKING TOWARD COMPLETELY DISMANTLING OBSOLETE TITAN II MISSILES. THE ALARMING GROWTH, BOTH IN QUANTITY AND QUALITY, OF SOVIET BALLISTIC MISSILES OVER THE LAST DECADE IS YIELDING A HARD TARGET, FIRST STRIKE FORCE CAPABLE OF ACCURATELY REACHING ITS TARGETS IN MINUTES. THE RESULTING ASYMMETRY BETWEEN SOVIET AND U.S. FORCE STRUCTURES HAS LED TO A DESTABILIZING SITUATION, ONE THAT MUST BE REDRESSED.

AT THE SAME TIME THAT IT HAS WORKED TO IMPROVE ITS OFFENSES, THE SOVIET UNION HAS CONTINUED TO DEVELOP AND IMPROVE ACTIVE DEFENSES. THESE ACTIVE DEFENSES PROVIDE THE SOVIET UNION A STEADILY INCREASING CAPABILITY TO COUNTER THE RETALIATORY FORCES OF THE U.S. AND ITS ALLIES, ESPECIALLY IF THOSE FORCES WERE TO BE DEGRADED BY A SOVIET FIRST STRIKE AS PROVIDED FOR IN SOVIET MILITARY DOCTRINE. EVEN TODAY, SOVIET ACTIVE DEFENSES ARE EXTENSIVE. FOR EXAMPLE, THE SOVIET UNION POSSESSES THE WORLD'S ONLY OPERATIONAL ANTIBALLISTIC MISSILE (ABM) SYSTEM, DEPLOYED AROUND MOSCOW. THE SOVIET UNION CURRENTLY IS IMPROVING ALL ELEMENTS OF THIS SYSTEM. THE SOVIETS ARE ALSO DEVELOPING

COMPONENTS OF A NEW ABM SYSTEM THAT APPARENTLY ARE DESIGNED TO ALLOW THEM TO CONSTRUCT INDIVIDUAL ABM SITES IN A MATTER OF MONTHS RATHER THAN THE YEARS REQUIRED FOR MORE TRADITIONAL ABM SYSTEMS. THE SOVIET UNION ALSO HAS THE WORLD'S ONLY OPERATIONAL ANTI-SATELLITE (ASAT) CAPABILITY. IT HAS AN EXTENSIVE AIR DEFENSE NETWORK, WHICH IS CONTINUING TO IMPROVE, AND IT IS AGGRESSIVELY IMPROVING THE QUALITY OF ITS RADARS, INTERCEPTOR AIRCRAFT, AND SURFACE-TO-AIR MISSILES. THE LATEST SOVIET SAMs, THE SA-10 AND SA-X-12, ALSO ARE CAPABLE OF COUNTERING TACTICAL BALLISTIC MISSILES AND POSSIBLY EVEN SOME STRATEGIC BALLISTIC MISSILES. IT ALSO HAS A VERY EXTENSIVE NETWORK OF BALLISTIC MISSILE EARLY WARNING RADARS. ALL OF THESE ELEMENTS PROVIDE THEM AN AREA OF RELATIVE ADVANTAGE IN STRATEGIC DEFENSE TODAY AND, WITH LOGICAL EVOLUTIONARY IMPROVEMENT, COULD PROVIDE THE FOUNDATION FOR A DECISIVE ADVANTAGE IN THE FUTURE. SINCE THE 1960s, THE SOVIETS HAVE BEEN PURSUING RESEARCH INTO ADVANCED TECHNOLOGIES FOR STRATEGIC DEFENSE. THESE TECHNOLOGIES INCLUDE HIGH ENERGY LASERS, PARTICLE BEAM WEAPONS, RADIO FREQUENCY WEAPONS, AND KINETIC ENERGY WEAPONS. MOREOVER, DURING THIS SAME PERIOD, THE SOVIETS HAVE HAD AN ACTIVE AND EXPANDING MILITARY SPACE PROGRAM. THIS INFORMATION ONLY REINFORCES OUR NEED TO PURSUE THE SDI'S RESEARCH PROGRAM AS EXPEDIOUSLY AS POSSIBLE.

ONE POINT I WISH TO MAKE INITIALLY NEEDS TO BE FULLY UNDERSTOOD: WE ARE CONDUCTING THIS PROGRAM IN FULL COMPLIANCE WITH OUR TREATY OBLIGATIONS AND INTERNATIONAL AGREEMENTS. THE PRESIDENT HAS DIRECTED THAT THE PROGRAM BE FORMULATED IN A FULLY COMPLIANT MANNER, AND THE DEPARTMENT OF DEFENSE HAS PLANNED AND REVIEW THE PROGRAM (AND WILL CONTINUE TO DO SO) TO ENSURE THAT IT REMAINS WITHIN THE PROVISIONS OF U.S. TREATY COMMITMENTS.

BEFORE I DISCUSS THE FISCAL YEAR 1987 PROGRAM I WOULD LIKE TO DISCUSS THE REALITIES OF OUR PROGRAM EXECUTION DATE. SOME HAVE ASSERTED THAT THE AMOUNTS OF MONEY WE HAVE REQUESTED FOR

RESEARCH ARE UNPRECEDENTED AND CANNOT BE SPENT. IN MY TESTIMONY LAST YEAR I INDICATED THAT I FELT WE WOULD COMPARE VERY FAVORABLY WITH THE OTHER SERVICES' RESEARCH AND DEVELOPMENT OBLIGATIONS AND EXPENDITURES. IN FACT OUR OBLIGATION RATE AT THE END OF FISCAL YEAR 1985 WAS 94 PERCENT, HIGHER THAN THE SERVICES AND DARPA. OUR EXPENDITURE OF 40 PERCENT WAS BETWEEN THE LEVELS OF THE SERVICES. AS FAR AS SDI BEING UNPRECEDENTED IN REQUESTING SUCH GROWTH IN RESEARCH AND DEVELOPMENT FUNDING, THIS IS SIMPLY NOT ACCURATE. THE MANHATTAN AND APOLLO PROGRAM BOTH EXPERIENCED FUNDING GROWTH IN EXCESS OF REQUESTS SUBMITTED BY SDI.

UNFORTUNATELY, OUR REQUESTS FOR FUNDING IN PREVIOUS YEARS HAVE BEEN REDUCED SIGNIFICANTLY, FORCING US TO REDESIGN PROGRAM EXECUTION AND PLANNING. IN FY 1985 AND FY 1986 CONGRESS REDUCED BUDGET REQUESTS APPROXIMATELY 25 PERCENT. BILLION DOLLAR REDUCTIONS HAVE CAUSED US TO ACCEPT HIGHER PROGRAM RISKS, PREMATURELY DOWN SELECT CERTAIN PROMISING TECHNOLOGIES AND IN GENERAL PURSUE A MORE AUSTERE RESEARCH PROGRAM. THE REDUCTION OF THE REQUESTED BUDGET LEVELS BY CONGRESS HAS NOT, AS YET, HAD THE EFFECT OF SLOWING PROJECT SCHEDULES FOR THE PRESENT PROOF-OF-FEASIBILITY EXPERIMENTS. IT HAS HAD THE EFFECT, HOWEVER, OF NOT ALLOWING THE SDIO TO FUND THE ALTERNATIVE OR FALL-BACK TECHNOLOGIES AT AN ADEQUATE LEVEL TO MINIMIZE PROGRAM RISK. THUS, CONGRESSIONAL BUDGET REDUCTIONS HAVE HAD A HARMFUL IMPACT ON SDI RESEARCH AND FORCED MAJOR PROGRAM CHANGES. WE HAVE BEEN FORCED TO REDUCE THE EFFORT ON CERTAIN MAJOR TECHNOLOGIES SUCH AS SPACE-BASED LASERS PREMATURELY. THIS WILL INCREASE SIGNIFICANTLY PROGRAM RISK AND COULD CAUSE PROGRAM SLIPPAGE, THEREBY DELAYING COMPLETION AND INCREASING TOTAL COSTS. THIS IS BUT ONE EXAMPLE OF THE MANY REDUCTIONS WE HAVE BEEN FORCED TO MAKE.

IN FY 1987 WE ARE REQUESTING $4.8 BILLION TO SUPPORT RESEARCH FOR THE STRATEGIC DEFENSE INITIATIVE. THIS FUNDING LEVEL ONLY ATTEMPTS TO MOVE CLOSER TO THE LEVELS RECOMMENDED BY

THE FLETCHER STUDY IN 1983. IT IS IMPERATIVE THAT WE RESTORE THE FUNDING LEVELS IF WE ARE TO REACH OUR GOAL OF PROVIDING SUFFICIENT INFORMATION TO SUPPORT STRATEGIC DEFENSE DECISIONS IN THE EARLY 1990's. THE FY 1987 REQUEST SUPPORTS THE ARCHITECTURE DEVELOPMENT, MAJOR EXPERIMENTS, TECHNOLOGY DEVELOPMENT, AND INNOVATIVE SCIENCE AND TECHNOLOGY RESEARCH TO ACHIEVE THAT GOAL.

OUR APPROACH TO REACHING THE GOAL OF PROVIDING THE DEFENSE OPTIONS NECESSARY FOR AN INFORMED DECISION IN THE EARLY 1990's HAS NOT CHANGED. ESSENTIALLY THE SDI, IN ORDER TO BE EFFECTIVE, MUST BE ABLE TO DETECT THE ATTACK, TRACK, IDENTIFY AND DISCRIMINATE THE TARGET, INTERCEPT AND DESTROY THE TARGET AND TO BATTLE MANAGE AND COORDINATE ALL THESE ACTIVITIES. IN ADDITION, ANY PROPOSED SDI SYSTEM MUST BE SURVIVABLE AND AFFORDABLE. OUR WHOLE PROGRAM IS BASED ON OUR DESIRE TO PROVIDE ANSWERS TO THESE KEY TECHNOLOGY QUESTIONS TO THE DECISION MAKING AUTHORITIES, i.e. THE PRESIDENT AND THE CONGRESS, AS THOROUGHLY, RAPIDLY AND AS COST EFFECTIVELY AS POSSIBLE. OUR PREVIOUS YEARS' EFFORTS HAVE BEGUN THIS PROCESS AND THE FY 1987 REQUEST EXPANDS THE INFORMATION.

BY LATE FY 1985, PHASE I OF THE SYSTEM ARCHITECTURE AND TRADEOFF STUDY WAS COMPLETED BY TEN INDUSTRIAL CONTRACTOR TEAMS. CLASSES OF ARCHITECTURES FOR BALLISTIC MISSILE DEFENSE WERE IDENTIFIED AND KEY ISSUES IN ACHIEVING THOSE ARCHITECTURES EXPLORED. PHASE II, WITH THE NUMBER OF CONTRACTORS REDUCED TO FIVE, IS EXAMINING THE CLASSES OF ARCHITECTURES AND ISSUES IN GREATER DETAIL. WHILE WE HAVE FOUND A HEALTHY DIVERSITY OF OPINION ON HOW TO RESOLVE KEY ISSUES, WE ALSO EXPECT AGREEMENT ON THE KEY FEATURES OF BALLISTIC MISSILE DEFENSE ARCHITECTURES. POINTS OF MAJOR IMPORTANCE THAT HAVE EMERGED ARE:

o THE MOST ROBUST ARCHITECTURE COMBINES BOTH SPACE-AND GROUND-BASED ELEMENTS. THE SPACE-BASED ASSETS ARE COFIGURED TO PROVIDE EFFECTIVE DEFENSE DURING THE

BOOST, POST-BOOST, AND MIDCOURSE PHASES OF THE THREAT TRAJECTORY. THEY ALSO PROVIDE SELF DEFENSE AND PROTECT AGAINST VARIOUS DEFENSE SUPPRESSION THREATS. THE GROUND-BASED COMPONENTS ARE USED TO ENGAGE THE THREAT DURING THE LATE MIDCOURSE PART OF THE THREAT TRAJECTORY AND WITHIN THE ATMOSPHERE AT HIGH ALTITUDES. THE LARGE NUMBER OF OPPORTUNITIES TO ENGAGE THE THREAT WITH THIS ARCHITECTURE LEADS TO AN EXPECTATION OF ACHIEVING VERY LOW LEVELS OF DEFENSE LEAKAGE EVEN IF THE ENEMY PROLIFERATES HIS OFFENSIVE FORCES IN RESPONSE TO OUR DEFENSE.

o WE MUST FULLY EXPLORE TECHNOLOGIES THAT COULD PROVIDE SYSTEMS TO ENGAGE HOSTILE BALLISTIC MISSILES IN THE BOOST AND POST-BOOST PHASES. THE LEVERAGE AFFORDED BY DEFENSIVE ACTION AT THESE STAGES OF A HOSTILE BALLISTIC MISSILE'S FLIGHT CAN BE DECISIVE. CONCEIVABLY, THE HIGHEST PAYOFF AND THE GREATEST RETURN FOR THE DEFENSIVE DOLLAR INVESTMENT WOULD OCCUR IN THESE PHASES, BEFORE DEPLOYMENT OF A MISSILE'S WARHEADS AND ASSOCIATED PENETRATION AIDS.

o DATA HANDLING, ALONG WITH COMMAND AND CONTROL FOR TECHNOLOGIES, FOR LAYERED DEFENSES MUST MAINTAIN A HIGH PRIORITY WITHIN THE SDI PROGRAM. NO MATTER WHAT EVOLVES FROM OUR RESEARCH IN OTHER AREAS OF THE PROGRAM, RELIABLE, RESILIENT AND RESPONSIVE DATA HANDLING AND COMMAND AND CONTROL CAPABILITIES ARE REQUISITE.

o BEYOND THE BOOST AND POST-BOOST REALM, A HIGH PRIORITY IS TO CONDUCT THOROUGH EXAMINATIONS OF POTENTIAL CAPABILITIES IN OTHER LAYERS. THE CAPABILITY TO PERFORM DEFENSIVE ENGAGEMENTS IN THE MIDCOURSE AND TERMINAL PHASES IS CRITICAL TO THE FULL EXPLOITATION OF THE ADVANTAGES OF A LAYERED DEFENSE.

o GOOD EXOATMOSPHERIC DISCRIMINATION IS ESSENTIAL TO EFFECTIVE MIDCOURSE DEFENSE. IN ADDITION, MIDCOURSE DEFENSE WITH GOOD DISCRIMINATION CAPABILITY CAN OPERATE SYNERGISTICALLY WITH THE BOOST PHASE DEFENSE BY OFFSETTING THE IMPACT

OF FAST BURN BOOSTERS ON BOOST PHASE INTERCEPT.

o IT IS HARD TO OVERESTIMATE THE IMPORTANCE OF THE GENERATION OF REALISTIC THREAT MODELS, THE ESTIMATION OF THE VULNERABILITY OF TARGETS TO THE NUMEROUS KILL MECHANISM OPTIONS BEING EXPLOITED, AND THE DEVELOPMENT OF STRATEGIES, TACTICS AND TECHNOLOGY TO ENSURE SYSTEM SURVIVABILITY TO MISSION COMPLETION. THESE ANALYSES AND ESTIMATES WILL PROVIDE THE BOUNDARIES FOR MEASURING SUCCESS.

o SUCCESS IN NEARLY EVERY ELEMENT OF THE PROGRAM IS DEPENDENT ON MAJOR ADVANCES IN SUPPORTING TECHNOLOGIES FOR SPACE-BASED ELECTRIC POWER, POWER CONDITIONING LOW COST DEVICES, SPACE TRANSPORTATION AND LOGISTICS.

o WE MUST ACCELERATE EXAMINATION OF POTENTIAL APPLICATIONS TO THE SHORT-RANGE THREAT. OUR SECURITY IS INEXTRICABLY LINKED TO THAT OF OUR ALLIES. WE CANNOT CONFINE OURSELVE SOLELY TO AN EXPLORATION OF TECHNOLOGIES WITH PROMISE AGAINST LONG RANGE, LAND-AND SEA-LAUNCHED BALLISTIC MISSILES. THUS, THE ARCHITECTURE STUDIES REINFORCE OUR VIEWS ON THE ROLE OF BOOST PHASE INTERCEPT; DISCRIMINATION OF DECOYS FROM WARHEADS; MIDCOURSE AND TERMINAL INTERCEPT; BASING OF DEFENSE ASSETS IN SPACE; COMMAND, CONTROL, COMMUNICATIONS AND BATTLE MANAGEMENT; AND THREAT MODELING, SURVIVABILITY, AND TARGET VULNERABILITY. AT THE SAME TIME, OUR RESEARCH HAS ALREADY YIELDED IMPORTANT RESULTS FROM EFFORTS SPECIFICALLY ADDRESSING THESE ISSUES.

o IN DISCRIMINATION, WE HAVE SEEN OUTSTANDING PROGRESS IN IMAGING, PARTICULARLY THROUGH PHASED-ARRAY RADAR TECHNOLOGY AND SIGNAL PROCESSING IMPROVEMENTS. EQUALLY IMPORTANT, THE DIRECTED ENERGY EFFORTS HAVE GIVEN US AN APPROACH TO "INTERACTIVE" DISCRIMINATION.

o THE SURVEILLANCE AND SENSOR PROGRAM AREAS HAVE WITNESSED IMPRESSIVE PROGRESS. MINIATURIATION AND ADVANCES IN OPTICAL SENSORS HAVE PROVIDED RAPID GAINS IN SURVEILLANCE TECHNOLOGIES. MULTI-SPECTRAL MEASUREMENTS OF BOOSTER, POST-BOOST VEHICLE, AND REENTRY VEHICLE SIGNATURES HAVE BEEN OBTAINED BY BOTH OPTICAL AND RADAR DEVICES. THESE MEASUREMENTS ALLOW US

TO UNDERSTAND THREAT SIGNATURES AND WILL BE USED IN THE DEVELOPMENT OF SENSOR TECHNOLOGY. ADDITIONALLY, WE HAVE ACHIEVED SIGNIFICANT PROGRESS IN TECHNOLOGIES FOR HARDENING OF HIGH DENSITY MICROELECTRONIC PROCESSORS AND INFRARED (IR) FOCAL PLANE ARRAYS AGAINST THE EFFECT OF NUCLEAR RADIATION THAT WOULD BE EXPERIENCED DURING A BATTLE.

o IN THE DIRECTED ENERGY FIELD, WORK WITH ATMOSPHERIC COMPENSATION AND FREE ELECTRON LASER TECHNOLOGIES HAS PROGRESSED TO THE POINT WHERE IT APPEARS THAT THE POTENTIAL FOR LARGE, EFFECTIVE GROUND-BASED LASER SYSTEMS IS VERY REAL.

o IN ELECTROMAGNETIC ACCELERATOR OR "RAIL GUN" RESEARCH WE HAVE SHOWN THE ABILITY TO INPUT HIGH LEVELS OF POWER TO THESE DEVICES FAR SOONER THAN EXPECTED. THIS MEANS THAT HEAVIER PROJECTILES COULD BE USED AND/OR HIGHER SPEEDS ATTAINED.

o A SIGNIFICANT RECENT ACCOMPLISHMENT HAS BEEN THE MIDCOURSE INTERCEPT OF AN ACTUAL REENTRY VEHICLE BY AN AUTONOMOUS TERMINAL HOMING INTERCEPTOR. THIS EXPERIMENT PROVED THE CAPABILITY OF A NONNUCLEAR INTERCEPTOR LAUNCHER FROM THE GROUND TO DEMOLISH AN INCOMING BALLISTIC MISSILE PAYLOAD OUTSIDE THE EARTH'S ATMOSPHERE AT A CLOSING SPEED OF OVER 20,000 MILES PER HOUR.

o IN HARDENING ELECTRONIC CIRCUITS AND DEVICES FOR COMPUTERS AGAINST NUCLEAR RADIATION, WE HAVE FABRICATED AND TESTED RADIATION-HARDENED, LARGE SCALE, INTEGRATED CIRCUITS THAT SHOW THE POTENTIAL FOR INCORPORATING SIGNIFICANT ONBOARD PROCESSING FOR SPACECRAFT IN HIGH RADIATION ENVIRONMENTS.

o A DISTRIBUTED COMPUTER THAT NETWORKS SEVERAL STANDARD COMMERCIAL COMPUTERS INTO A VIRTUAL MEMORY SYSTEM IS NOW OPERATIONAL. IT IS PROVIDING TEST BEDS FOR BATTLE MANAGEMENT CONCEPTS.

o IN LETHALITY AND TARGET HARDENING, WE HAVE CONDUCTED MANY TESTS TO ANALYZE AND QUANTIFY DAMAGE EFFECTS AND VULNERABILITIES TO RADIATION AND HIGH SPEED PROJECTILES. ONE OF THE MORE GRAPHIC TESTS INVOLVED

DESTRUCTION OF A ROCKET BODY BY A LASER ON GROUND RANGE. OTHER TESTS HAVE EXAMINED THE EFFECTS OF X-RAYS ON LASER MIRRORS. OTHER EFFECTS TESTS HAVE SHOWN THAT SMALL PLASTIC PROJECTILES TRAVELLING AT 7 KM/SEC AND IMPACTING ALUMINUM CAN CREATE LARGE CRATERS.

THE FY 87 PROGRAM IS DESIGNED TO PURSUE THE TECHNOLOGY DEVELOPMENT AND ARCHITECTURAL DEFINITION PREVIOUSLY ESTABLISHED. ALTHOUGH IT IS WELL BEYOND THE SCOPE OF THIS TESTIMONY TO MENTION EVERY PROGRAM ENCOMPASSED IN THE VAST ARRAY OF SDI-RELATED ACTIVITIES BEING CONDUCTED BY EITHER THE SDIO OR THE SERVICES, I WOULD LIKE TO HIGHLIGHT SOME OF THE AREAS WHERE WE INTEND TO APPLY THE MAJOR THRUST OF OUR RESEARCH EFFORT IN FY 1987. THIS YEAR OUR RESEARCH IS EVOLVING MORE FROM THE TECHNOLOGY DEVELOPMENT INTO MAJOR EXPERIMENTS. THESE EXPERIMENTS ARE MORE COSTLY, BUT BEYOND ANY DOUBT, ARE REQUIRED IN ORDER TO ANSWER TECHNOLOGY QUESTIONS. THE VERY COMPLEX DETAILS OF TECHNICAL CONTENT SCHEDULE, COST AND DELIVERABLES IN EACH OF THESE EXPERIMENTS ARE INCLUDED IN OUR CLASSIFIED DESCRIPTIVE SUMMARIES AND THE REPORT TO CONGRESS. I WILL GIVE SPECIFIC EXAMPLES IN MY BRIEFING BUT LET ME MENTION SOME EXAMPLES OF THESE EXPERIMENTS. MAJOR EFFORTS IN FY 1987 INCLUDE THE NATIONAL TEST BED, THE TERMINAL DEFENSE TIER TESTS, THE ENDO-ATMOSPHERIC INTERCEPTOR, BOOST SURVEILLANCE SYSTEM, SPACE BASE BM/C^3 AND THE FREE ELECTRON LASER. WITHOUT THE FUNDING TO PROGRESS TO THE INTEGRATED EXPERIMENT STAGE THAT THESE EXAMPLES REPRESENT WE CLEARLY WILL NOT BE ABLE TO ANSWER TO THE SATISFACTION OF OUR DECISION MAKERS THAT WE HAVE SOLVED THE TECHNOLOGICAL QUESTIONS WE FACE. THE INTEGRATED EXPERIMENTS ARE THE LOGICAL NEXT STEP, THEY WERE NEVER PROTRAYED AS BEING INEXPENSIVE BUT WITHOUT THEM THE PROBABILITY OF DETERMING IF THE SDI IS FEASIBLE IS VERY LOW.

AS WE MOVE INTO FY 1987, I WOULD LIKE TO CLOSE BY HIGHLIGHTING TWO AREAS SLIGHTLY OUTSIDE THE BUDGET REQUEST ITSELF. THE FIRST IS THE EFFORT WE ARE MAKING IN THE AREA OF

MEDICAL RESEARCH USING THE RESEARCH INTO FREE ELECTRON LASER (FEL) TECHNOLOGY. THE PROGRAM HAS THREE MAJOR COMPONENTS: FEL TECHNOLOGY, PRE-CLINICAL STUDIES, AND FUNDAMENTAL STUDIES IN BIOLOGY AND MATERIAL SCIENCE. IN FY 1985 FUNDS WERE PROVIDED FOR CONSTRUCTION AND OPERATION OF FOUR FEL FACILITIES: TWO AT STANFORD UNIVERSITY, ONE AT THE UNIVERSITY OF CALIFORNIA/SANTA BARBARA, AND A FOURTH AT MASSACHUSETTS GENERAL HOSPITAL. EACH OF THESE CENTERS ARE EXPECTED TO PLAY A MAJOR ROLE IN EXPLOITING FEL TECHNOLOGY FOR BIOMEDICAL/MATERIAL SCIENCES, AND IN TRAINING OF STUDENTS FOR THE FUTURE. SEVEN ADDITIONAL AWARDS WERE MADE TO MULTI-DISCIPLINARY RESEARCH GROUPS THAT WILL MAKE USE OF THESE CENTERS. PLANS FOR FY 1986 INCLUDE ADDITION OF TWO MORE FEL FACILITIES. THE SDIO IS DELIGHTED TO BE ABLE TO APPLY ITS EXPERTISE IN FEL SCIENCE TO THIS VERY WORTHY ENTERPRISE FOR THE BENEFIT OF MANKIND.

SECOND, WE CAN ALSO SHOW PROGRESS IN OUR DEALINGS WITH OUR ALLIES. MANY OF OUR ALLIES HAVE INDICATED SUPPORT FOR SDI RESEARCH AND IN SOME CASES INTEREST IN PARTICIPATING. ON DECEMBER 6, 1985, THE SECRETARY OF DEFENSE AND THE BRITISH DEFENSE MINISTER SIGNED A GOVERNMENT-TO-GOVERNMENT AGREEMENT CONCERNING SDI RESEARCH INVOLVEMENT, AND OTHER ALLIED GOVERNMENTS APPEAR INTERESTED IN SIMILAR ACCORDS. U.S. AND ALLIED SECURITY REMAINS INDIVISIBLE AND WE WILL CONTINUE TO WORK CLOSELY WITH OUR ALLIES TO ENSURE THAT, AS RESEARCH PROGRESSES, ALLIED VIEWS ARE CAREFULLY CONSIDERED. IN ADDITION TO DIRECT PARTICIPATION IN THE PROGRAM, CONTRIBUTIONS BY OUR ALLIES COULD INCLUDE INNOVATIVE UNIVERSITY RESEARCH, INDIVIDUAL EXCHANGES, OR SUBCONTRACTS TO U.S. INDUSTRY.

MR. CHAIRMAN, I HOPE MY TESTIMONY TODAY CAN ADVANCE THE DIALOGUE AND UNDERSTANDING OF WHAT WE HAVE ACCOMPLISHED AND THE FUTURE DIRECTION OF THE SDI PROGRAM. I CONTINUE TO BE EXCITED

ABOUT THE PROGRESS WE ARE MAKING AND THE CHALLENGES WE FACE. I LOOK FORWARD TO WORKING WITH YOU, THE COMMITTEE, AND YOUR STAFF IN PURSUING THE STRATEGIC DEFENSE INITIATIVE. THANK YOU FOR THIS OPPORTUNITY TO PRESENT OUR RESEARCH PROGRAM.

FACTFINDING TRIP TO OVERVIEW SDI

Senator STEVENS. Thank you very much. We appreciate that.

I must say in addition to the four scheduled hearings and perhaps a fifth one to give you a chance to rebut what might develop in the open hearings that we are going to have from non-Government witnesses, it is my intention to schedule a trip for a weekend for any member of the subcommittee that would like to come along to go to Las Alamos, CA, Institute of Technology and Jet Propulsion Lab in Pasadena and Livermore and to go to the Strategic Defense Command in Huntsville, AL.

It will be a 4-day trip for which it will be necessary to have a complete overview of SDI. That will be scheduled we hope sometime in May. We need some cooperation by the leadership to do that. I think it is important for us.

This will be our major issue this year to have full availability of all information for all members of the committee.

I yield to my friend, Senator Proxmire.

BREAKTHROUGHS IN STAR WARS PROGRAM

Senator PROXMIRE. General Abrahamson, since the Summit Conference last fall there has been what appears to be a well-coordinated attempt to sell Star Wars. There have been reports from you and other administration officials of amazing progress and tremendous breakthroughs in the Star Wars Program.

PROGRAM CRITICISM FROM SDI SCIENTISTS

Many scientists have been critical of those inflated claims and your hyping of the program. As it turns out, these complaints are not coming from the Union of Concerned Scientists or not coming from critics of the program; they are coming from your own scientists, the ones working on SDI.

They are the ones that say there have not been spectacular breakthroughs as you have claimed. There has been progress, but not amazing progress. Corey Call, Director of SDI Systems Studies at Lawrence Livermore, told Newsletter Defense Week, SDI officials have made "outlandish statements that are not technically grounded in order to sell the program to the administration and to the Congress."

Ray Kidder, a physicist at Livermore, was quoted as saying, "The public is getting swindled by one side that has access to classified information. It can say whatever it wants and not go to jail, whereas the skeptics cannot say what they want. They would go to jail if they do. What is the difference?"

What is your response to that?

General ABRAHAMSON. First of all, there are some highly competitive teams out there who believe in their particular concept and some of those teams are out selling those concepts not only to me, but to the public as well.

I believe that those kinds of comments are aimed more at some of the differences between the people who are participating in the program than what our overall conjecture is.

Now, I have indeed said that there has been, in my judgment, very amazing progress. I am delighted to see that. I have only described a couple of things as what I consider to be major breakthroughs and I think that that is the case.

I think you will see, sir, if you are able to join the team as they go around, that there is real progress in the program. Nonetheless, this is a tremendous country and people are entitled to their opinions and some of them will state them that way.

FEASIBILITY OF STAR WARS QUESTIONED

Senator PROXMIRE. It is devastating since it came from people at the Livermore Lab working on SDI or on the payroll.

In a speech you made on February 26 to the American Defense Preparedness Association you said, "We are nearly there. There is no longer a question of if. It is a question of how long and how expensive."

Now, I am really astonished by that statement because the scientists at the National Weapons Lab studying Star Wars plus the program and project managers working on it say they still do not know whether Star Wars is feasible.

That is why we have launched this massive research program to determine whether Star Wars can work. According to your own time lines, you said you will not be able to make a decision on Star Wars feasibility until the early 1990's. Even then, you said there will be lots of risks involved in making that decision.

Can you explain why you are now saying Star Wars is feasible when your own scientists still do not know whether it is feasible?

General ABRAHAMSON. I think I expressed that in my opening comments, sir, that I believe what we have made is enough technical progress that we can see ahead that there are indeed feasible ways, technically feasible ways, of taking ballistic missiles and being able to counter the threat that they represent.

Frankly, I believe that there has been very substantial progress. As I said in my briefing, feasibility has other components. One of those is cost effectiveness and certainly there is additional work that has to be done in countermeasures.

Whenever I have said that, we have made progress and I do believe that we have made amazing progress, I have also said that I feel that we have already established technically feasible ways so that the ballistic missile is not the omnipotent weapon that many people seem to have conceded from the start.

I have always said that there is still a long way to go primarily in order to give you, the Congress, and, frankly, the Generals in the Pentagon, a responsible viewpoint on what it would cost in development and production of a practical weapon system.

There is a difference between technical feasibility and the fact that we can destroy ballistic missiles, which has not been conceded in the past, and having the basis for a good solid development in production and employment decisions.

Senator PROXMIRE. In general, would you agree with your scientists who say we do not know as yet whether or not this system is feasible? Is that right?

General ABRAHAMSON. I stand by exactly the way I said it, sir. In terms of technical feasibility, I think we have already demonstrated that many of these concepts can work or have the hope of working.

However, I do not know what the cost will be yet. I am trying to begin to work on that in some responsible ways. Let me give you one example, if I might.

HOMING OVERLAY INTERCEPT

We demonstrated technical feasibility that a nonnuclear intercept can be made back in June 1984. We did this in a rather marvelous experiment that the Army conducted, the Homing Overlay Experiment [HOE]. That was with a vehicle that was very expensive. It cost a great deal of money.

And now the next phase of the research is to produce those vehicles or see that we have the technology to produce them for under a million dollars each. That is the unknown part of it.

PLANE ADJUNCT

Senator PROXMIRE. Can you give us a rundown on the problems with the plane adjunct, a plane that was supposed to discriminate and track Soviet warheads as they enter the atmosphere?

According to the reports I have received, you discovered 8 months after you signed the AOA contract you were going to have a whopping big cost overrun of $103 million. In order to avoid embarrassment of such an overrun coming to light, SDI canceled a $62 million subcontractor with Aerojet to partly offset the overrun.

First, isn't it a fact Boeing bought into this contract?

Second, how is it that SDI did not know this was a buy-in, considering the cost overrun came so quickly after the contract was signed?

Isn't it a fact by canceling the Aerojet contract in order to offset the cost overrun, SDI will be testing less capable sensors than if we had kept the jet onboard?

General ABRAHAMSON. No. 1, there was an element of undercosting on the AOA. Whether or not it was a buy-in or deliberate, I cannot say. There is no way to measure what the motivations of the people were.

No. 2, I think it was responsible management, both on the part of the Army——

Senator PROXMIRE. What management?

General ABRAHAMSON. Responsible—to take early action to control exactly that, and our judgment was that even though the sensor might be less capable and there certainly is more risk in the program, we are still demonstrating the feasibility of using this kind of system to augment radar in the future.

I understand what you are saying. We should not be getting those kinds of surprises, but this is not a development program; this is a research program.

I think it is to the Army's credit and to our credit that we took fast action to contain the cost growth.

SDI PROGRAM PRIORITIES

Senator PROXMIRE. I notice there has been radical changes in the priorities of the SDI Program in the past year.

I also notice that many of the programs that I criticized last year as being overfunded because they lacked military utility, you now in fact down-select for the same reason. Last year in the SDI budget we proposed cutting funding for space-based chemical lasers from the $348 million you requested to $169 million.

You criticized that proposed cut because you said it would delay promising directed energy projects. I look at the fiscal 1986 budget, a $2.76 billion funding level, and you have cut funding for space-based chemical lasers even more than I would cut. You cut it down to $145 million. You have been blaming Congress for these cuts in this project.

Isn't it a fact you made this drastic cut in space chemical lasers because SDI finally came to realize what we had been saying last year was true: these types of lasers had too many operational limitations, too many vulnerabilities, to be militarily effective?

Congress did not force you to cut the program as much as you did. Isn't it a fact you took money out of this program which you realized was overfunded and other projects had greater priority?

General ABRAHAMSON. I have obviously applied priorities to the program. Obviously, we looked at that very, very carefully and our judgment was that it had less promise and that it would cost more primarily because of the very large increased cost in space transportation, but also as we worked with the program over the years, we made architectural studies. We could see the cost of that part of the program building up in a way that there are more cost-effective ways with ground-based lasers.

I did make the judgment. However, now, perhaps you are inferring that we should not have made those judgments.

By the way, there are some rather profound technical regrets, sir, because what we are finding is that at those reduced levels there are some interesting breakthroughs that might change some of the cost equations.

That is the case in nearly each of these areas. This is a research program and it is not a development program. I think that is a profound difference as we go forward. It is also very dynamic. I do not want to base it on dollars.

Senator PROXMIRE. The reason I asked the question is that last year we were told space-based chemical lasers was the best thing coming down the pike.

General ABRAHAMSON. I did not say that.

FREE ELECTRON LASERS

Senator PROXMIRE. This year chemical lasers are out and free electron lasers are in. I suppose you will oppose any funding cut in free electron lasers.

Why should Congress believe these priorities need massive increases if these priorities are going to change from year to year?

General ABRAHAMSON. I think you would be very disappointed and taking exactly the opposite view if I came in just advocating and not make the kind of decisions you just referred to.

The difference between last year and this year is that we have taken early action to understand architectures and to do some very detailed tradeoff studies as well as to evaluate these.

By the way, I think that the light in which that ought to be presented is in a positive light and not just for my part of the decision process, but for all of the people and all of the contributors who in fact did examine those things and did set up priorities, as I indicated in the beginning.

I think that is my responsibility to you and to the taxpayers.

Now, will they change? I am sure there will be some change in the future. Will it change wishy-washy year to year? I believe that the basis of our architectural studies and what will continue over the next year will become more and more stable.

CLASSIFICATION OF GAO REPORT

Senator PROXMIRE. My time is about up. Let me ask finally the very question I asked in my opening statement as to why you classify the GAO report when all the information is available for a few hundred dollars to the Soviets to buy and put together?

General ABRAHAMSON. First of all, I do not believe we are denying any of the information to the Congress. I think there is a very important distinction to make in that area, sir. We are presenting to you in various classified levels all of the information that is necessary.

So, the real question, then, is how much should be presented out in the public documentation? Now, there is one very profound difference in levels of detail in that particular GAO report and what we included last year and what we intend to include this year.

That gets all the way to what we call our work package directive level. At that level of detail, we felt that to put all of that information in one particular document, what we have in effect done is to provide more information than was necessary for public consumption. The report also provided the hostile forces with sufficient information and a great deal of keys on where to go for SDI information and how much emphasis we are putting in at different levels.

Those were our reasons. I think we properly protected this under the Presidential executive order which does lay out criteria for classification. These were not entirely unclassified sources. Some of them were for official use only and some of them were unclassified, but it is the compilation at a level of detail that we think to be most significant. That is the reason I took the action.

That action does not deny you or any other Member of Congress or for that matter any other person with access to classified information at the proper levels the ability to have real insight into the program.

RESTRICTION OF INFORMATION TO CONGRESS

Senator PROXMIRE. You certainly deny the Congress the right to have the information if we cannot use it, discuss it, or debate it on the floor of the Senate. We cannot make our case to the public.

There really is a strict limitation. It is necessary sometimes. It is vital. You have that responsibility, it is a heavy one, I know. It is not satisfactory to say Congress has it when I cannot get up and discuss it in a meeting like this that is open, I cannot debate it on the floor of the Senate and use the information.

General ABRAHAMSON. Sir, I believe, and you made the point in a different way, that what we have done is that we have conducted the most open program of any one of these kinds, that we have made a great deal of the information available.

By the way, we have done that trying to be very careful and fully conscious of the things that are sensitive. We have also done this in the interest of what we think will be stabilizing for all of us by allowing people access information to discuss it.

If you will look at our open report, we have gone up to one level above what the GAO report provided and it is indeed, I think, sufficient basis so that you can make those kinds of points.

I very respectfully say that, sir, but I do not think that we have denied either the public and certainly not the Congress sufficient answer or sufficient data so that they can discuss it openly and make the point.

In fact, I have invited some of our most determined critics at the classified level to see the program. We have conducted continuing dialogues with these people, letters that go back and forth. It has been quite helpful because indeed what we have, I believe, come to some agreement on are very substantial errors, both in theirs and in some of our calculations.

Senator PROXMIRE. Thank you.

Senator STEVENS. Senator Johnston.

Senator JOHNSTON. Thank you, Mr. Chairman.

OVERSELLING OF SDI PROGRAM

The President and you are both great communicators. You are articulate, lucid, you are even likable, and that makes you a potent pair.

Let me say that I agree very much with Senator Proxmire that this program is hyped, it is oversold. You have co-opted the scientific community. It is very difficult to get the information out to the American public where real debate is going on. I think if they understood it as much as I do, they would be as upset as I am.

Let me clarify. I am for a robust R&D program, but I think we are going way beyond that. Let me add one or two things. We had a team going out looking at national labs. By the way, I commend to you and I know you are familiar with Harold Brown's article just out in Foreign Affairs.

In the national labs they are saying essentially in order to have a boost phase SDI, you have to have an arms agreement with the Soviets. In fact, at Sandia they put out this statement that says, "Strategic defense myth No. 1. Deficiencies and vulnerabilities in the defense can be offset by complementary arms control agreements."

What they mean is that you have hundreds of platforms going around. You have, according to your boost phase defense tier, you have thousands of space-based kinetic vehicles. You have probably hundreds of fighting mirrors, dozens of platforms for directed energy weapons. You have battle management command and control probably in synchronous orbit. I do not know how many of those you have.

You have space surveillance and tracking systems, 50 to 100 platforms. All these platforms up there which are very vulnerable to space-based mines or other kinds of vehicles being shot down in space.

Are we in agreement that an item orbiting in space is very vulnerable to being shot down by a space-based mine or other kinds of directed energy vehicle, or whatever?

General ABRAHAMSON. I am in agreement that something that is orbiting in space has to be carefully protected and has to be worked on. I do not concede that something that is in space is necessarily vulnerable or more vulnerable than a warhead or a rocket that must travel through space.

DEFENSE AGAINST INDISCRIMINATE SATELLITE DESTRUCTION

Senator JOHNSTON. We are in agreement that if you have something orbiting over the Soviet Union, if they wanted to, could shoot it down.

Is that fair?

General Abrahamson. No, I do not agree with that.

Senator JOHNSTON. How would you defend against that?

General ABRAHAMSON. There are quite a few ways to defend against it. Most of them, unfortunately, are classified.

Let me spend a few minutes and show you a few areas where we are searching for fundamental physical advantages. Let me discuss shooting with ground-based lasers.

Senator JOHNSTON. Let me move on because I am not going to be able to get to my other questions.

NECESSITY OF ARMS CONTROL AGREEMENT

At Sandia they say an arms control agreement is necessary. They say at Sandia you would need rules of the road, space keep-out zones, prohibitions on various things. You are saying Sandia is wrong, that you do not in effect need an arms control agreement, by these classified means you can make these hundreds of orbiting vehicles invulnerable to attack?

General ABRAHAMSON. I do not think we can make all of them invulnerable just like you cannot make an airplane invulnerable. People do not say that we should never use air power to try to go into a highly defended site. We know that certain individual aircraft will be shot down.

Nonetheless, all of the complementary forces and the complementary capability, the ability to maneuver, to use jamming, to use all of these kinds of things can be used so that you can get sufficient survivability so that the airplane has become a very potent weapon.

KINETIC ENERGY VEHICLES

Senator JOHNSTON. You have read the Harold Brown article, have you not?

General ABRAHAMSON. Not the latest one, but I know what his general thrust is.

Senator JOHNSTON. He says because kinetic energy weapons and conventional chemical lasers will be defeated by or suffer severe cost exchanges from defending countermeasures, the R&D program should concentrate more on kill mechanisms that are further off in time. He is saying kinetic energy weapons on which you are basing, at least initially, our defense, will not work, they can be defeated by these countermeaures. You disagree with that, of course?

General ABRAHAMSON. I believe that we can see the path in terms of the technology of some of the space-based kinetic kill vehicles more easily to a cost-effective kind of system.

On the other hand, I am not willing to concede that some of the advanced systems are very much further behind that. It really depends to a very significant degree on how creative and how effective some of the research in the advanced systems are.

Senator JOHNSTON. You testified you are going to base it at least initially on kinetic energy systems.

General ABRAHAMSON. I said I believe that the kinetic energy systems, that we know more about that and we are already able to say that that can be used as an initial system. Whether or not that will be a final recommendation is another question.

POP-UP X-RAY LASER

Senator JOHNSTON. You talk a lot about the pop-up x-ray laser. That can be defeated by the fast-burn rocket at least in the boost phase, can it not?

General ABRAHAMSON. No, and I am delighted you brought that up. Frankly, I am getting a little bored with some of the scientific community that concedes right in the very beginning. All they do is assume a fast-burn booster and they say that can defeat such a machine.

What I am bored with is the lack of critical evaluation in the public debate on exactly those kinds of systems. Let me explain what I mean by that.

A fast-burn booster may burn out at 50 or 60 or 120 seconds, but there is still the problem that it must deploy its warheads, it has to deploy them quickly or in a particular way. Even if it coasts up through the air, it is still a very hot object so that you can track it.

I do not concede that the fast-burn booster can just be assumed to be the answer to any of these directed energy systems.

Senator JOHNSTON. General, I am sorry not to let you go on at length, but you are going to take up my time and I will not be able to ask the questions.

Former Secretary Brown also says this:

SLIPPAGE IN BUDGET SCHEDULING

> Though congressionally approved funding is likely to exceed $2.5 billion in the current fiscal year, the scope of the program is so ambitious that schedules set only a year ago for systems decisions appear to be slipping and some difficult choices about priority will have to be made.

Is there any slipping in schedules?

General ABRAHAMSON. There are, sir. Part of it is because of some of the budget reductions. Part of it is where some of the research is not proceeding at the rate one would like. In other areas research is proceeding faster.

Senator JOHNSTON. He also says for defense of populations against a responsive threat they look poor through the year 2010 and beyond. He goes on to say it is very chancey even after that.

I take it you would strongly agree with him?

By the way, I would certainly recommend this article to you.

General ABRAHAMSON. I will read it very carefully, I promise.

Senator JOHNSTON. It is not a polemic, it is very scientific.

General ABRAHAMSON. I understand that.

Senator JOHNSTON. I think he is dead right.

Thank you, Mr. Chairman.

Senator STEVENS. Next is Senator Hollings.

Senator HOLLINGS. Jim is ahead of me.

Senator STEVENS. Senator Rudman will be next if you want to yield.

Senator RUDMAN. I thank my colleague.

FEASIBILITY OF SDI SYSTEM

General Abrahamson, I do not really believe any of us would assert that this panel has the kind of technical knowledge, even in a classified session, to get into a discussion of the relative merits of the technology you have been making your priority choices on. I think we have to depend heavily on you and your people to advise us as to what those priorities are.

Rather than be tempted to get into a technological discussion which I am afraid would be very one-sided, I want to ask you really only one question. You can take the rest of the time I have, how little or how much you want to answer.

I think your answer to Senator Proxmire was very interesting. Essentially, you put some parameters on feasibility. Something we do understand up here is the English language.

What you are saying is "Put some specifications on the word 'feasibility'."

Two, you stress that you really had no answers on, one, cost, which is fully understandable, and, two, to some extent timing, which is related to cost, but also stands independently.

If I understand your testimony correctly, what you were saying is, without quantifying it in terms of what percentage of warheads or rockets could be destroyed, you were saying that you are now sure that the technology exists to destroy incoming ICBM's either in the boost phase or as warheads.

Did I understand your testimony correctly?

General ABRAHAMSON. Yes, sir.

PROVEN TECHNOLOGY OF SDI

Senator RUDMAN. You are telling this committee that the technology as it has been modeled is now proven as far as you are concerned?

General ABRAHAMSON. We have confidence that the technology exists or that we can see that it will be here soon enough so that the technical feasibility of being able to destroy boosters or warheads is a reasonable kind of assumption. It is something that I think we can do.

Senator RUDMAN. To me that is the most important statement of the morning. Whether some people agree or disagree, you are in charge of the program, you have the three stars on your shoulder. Everybody is putting their faith in you and that is your testimony?

General ABRAHAMSON. Yes, sir.

COST GOALS ON KEY ELEMENTS OF SDI

Senator RUDMAN. Here is my question. Assuming we (a) give you the full amount of the appropriation, or assume (b) we make a percentage reduction similar to last year. My question is "what will you be able to tell us" a year from now when you are sitting before us, assuming that normal kinds of slippages might happen, nothing is perfect, on the other two aspects of feasibility you discussed here this morning?

I think you understand my question clearly and it is my only question.

General ABRAHAMSON. One of the management challenges that I have tried to set for our organization and for the people who will be implementing the program is to try to have set cost goals on these key elements over the next year.

In some cases we will have information that supports some of those cost goals. Most importantly, I believe that we should have enough technical information that we can set reasonable approximations of many of those cost goals similar to the one I talked about for the ERIS missile which is written into the Lockheed contract for their portion of the experimental program.

I think that is a very key step that we would have gained sufficient understanding that we can begin to lay out what I would hope to be reasonable cost goals. Otherwise, there will never be the ability to have an affordable system in the future. Now, I cannot guarantee that every one of those goals will be met. In fact, I will guarantee we will be clearly below some of them.

On the other hand, I think that is an important next step in the management program.

In addition to that, I think we will have more confidence at the smaller experimental level that we are making experimental progress and I think we will have a very significantly improved data base on what the Soviets can do to come back against us.

For example, I have talked about it before that while we are using lasers to try to understand how you destroy a booster with a laser, we are also building laser armor to see what is really feasible. This technology could be applied to boosters in a way that might force the performance of those lasers to be so high that it would be either cost prohibitive or technically infeasible.

In those cases I would come back and say lasers are not going to work.

TIME FRAME FOR SUCCESSFUL RESULTS OF SDI

Senator RUDMAN. Just to comment on your answer to see if I understand it: assuming you got the $4.8 billion—although I think there could be a problem with the full amount—next year at this hearing you will be able to start from where we were 3 years ago—on a very articulate program, broadly stated, with only a general scheme—and start to hone in on where you think you are going, how much it will cost and when you think it might be deployed.

Do you think by next year you can do that?

General ABRAHAMSON. The when is obviously a disappointment.

Senator RUDMAN. Do you have an idea about when?

General ABRAHAMSON. I still feel that the decision point at which we can have sufficient confidence is somewhere in the early 1990's. I have never been more specific than that.

Although I now have more confidence to be able to state that more specifically. We will also be able to state the ingredients of what that decision might be. Frankly, sir, that will be, as I indicated earlier, a very difficult technical decision.

Senator RUDMAN. Thank you very much for your answer.

I still have some time left, but I am not going to use it. I will just comment generally that the debate, Mr. Chairman, on this whole issue seems to treat the issue as if it were a development program or weapons system program, although it is really not.

I think we have an obligation even with the dissent to provide sufficient funds at least to get to the point of an answer. Whether the answer will come next year or the year after, we are talking about the total amount of money spent on defense.

I do not think anyone in the Congress is qualified to say it will not work or it cannot work or it will cost too much. Maybe we can say that next year or the year after. I certainly hope the program gets a good deal of support over the next year or two so that at least we know that much.

I also think, General, and I will repeat all the things my friend from Louisiana said about you, I have found you to be candid with this committee, both in public and in private. I think that is refreshing. I think that is the reason you get as much support as you get. I hope it continues.

General ABRAHAMSON. Thank you, sir.

Senator STEVENS. Senator Hollings.

Senator HOLLINGS. Thank you, Mr. Chairman.

Let me reiterate the very complimentary remarks. They are very much deserved.

ARMS CONTROL AGREEMENTS

Quickly, General Abrahamson, with respect to your reading, there was a Harvard senior about 45 years ago and he wrote his thesis on "Why England Slept." He traveled the continent with his father who was the Ambassador to the Court of Saint James. The question was why could the great British empire, the victor, be challenged by Germany, the vanquished, in a short 30-year period?

Amongst other things, you had similarities like we have today with the fever running around here; namely, that you have to get an arms control agreement before you get a defense.

Have you ever heard such a thing? If we are going to start from that premise, we are gone because we cannot get an arms control agreement that is enforceable. We have not had one.

I will give you Kissinger's statement that SALT I did not work. SALT II is properly not ratified. In any event, when you read in that book that you could not defend yourself from a bomber attack, they really believed that in 1940. So, it was an era of futility like permeates the land here, you cannot defend yourself from a missile attack.

In addition to Harold Brown, read John F. Kennedy and then read Mikhail Gorbachev. He believes very, very positively in strategic defense. He allocates billions upon billions for it. If you can find anything he said about it, please furnish me the articles, too. I know what he does. It speaks much louder than what he is saying.

BALLISTIC MISSILE DEFENSE SYSTEM

Now, on to the matter of a point of defense, ballistic missile defense system. Senator Wallop and I were very much exercised about the Soviets getting a tremendous and probably an uncontrollable advantage on us in BMD work and we put money in the budget for Huntsville and the Army had it. But you Air Force generals are more effective than the Army generals in getting money and now you are in control.

We had testimony to the effect from the Army that a point ballistic missile defense system would be operable by the year 1990 or 1991. Now, that has been put back since the Air Force has taken over the BMD work. When can we get a point defense BMD without interrupting your research on SDI? Could you make a projection on that particular score for us?

General ABRAHAMSON. Again, we put it in the context of the research program, sir. We have tried to structure the development program for both the research phase and development phase later on.

HEAD-ON MISSILE

You are talking about quite specifically the head-on missile which is a point defense weapon. It is one of the priority elements of the program. My judgment is that it must also have an AOA and also have a terminal imaging radar to go with it.

We are probably talking about being able to see that it is clearly not only feasible, but that we can have good cost estimates for all those things slightly earlier than an overall decision, but somewhere again in the 1990 time frame, if we have done our research correctly to determine what truly is affordable, that there are ways in which you can deploy it and cut down from what has always been a 10-year development cycle and to bring things into production.

I have never accepted that it has to take 10 years from the time that you go into a clear development program to the time that you begin to produce items and they get out. I think 5 years is much more appropriate. So, I think the mid-1990's is the right time.

APOLLO RESEARCH PROGRAM

Senator HOLLINGS. General, what about the Apollo research program? Can we make it comparable so that we as Senators can get a better grasp of whether we are going too fast, too slow, spending too much, too little?

How does the research on SDI at this particular time compare with the Apollo research program?

General ABRAHAMSON. Let me try a brief answer and I might like to add to it because I think it is a thoughtful question, sir.

In the very beginning when President Kennedy announced the Apollo program, there was a lot of disagreement among scientists of the kind referred to here, but in a different context. People, for example, did not know whether or not the Moon was covered with dust; if you landed on the Moon if you would just sink or if you would have a good hard surface from which you could blast off and come back.

There was a lot of this kind of internal debate among proponents of the program who were trying to go ahead. In that sense, I think there are some very similar things. It took about 2 to 3 years of true hard work to define what the best means of getting there truly were.

Because they did not know in the early days whether or not it is better to try to build a huge rocket that went right to the Moon or it was better to go into an Earth orbit and then leave from Earth orbit to go to the Moon or go into an orbit around the Moon, in a sense that is similar to what we are doing.

We are understanding the architecture and the kind of tradeoffs. After about approximately 3 years in the program, they really honed in on the hardware and the software and they began to develop the effort and began to do certain tests which gave them a great deal of confidence. So, after 9 years, of course, they were able to successfully land a man on the Moon.

I think that timing is not unlike what we are trying to do. The difference is that we are talking about a much broader scope, incredibly different scope.

As Senator John Glenn has pointed out to me time and time again, the Moon did not shoot back. Therefore, we have a more difficult challenge in the research program, both in thinking through how you conduct this chess game, in a sense, and also in the scope of the program.

Senator HOLLINGS. Thank you very much.

Mr. Chairman, I will submit my other questions.

Senator STEVENS. Senator McClure.

Senator McCLURE. Thank you very much, Mr. Chairman.

OPPOSITION TO LONG-TERM RESEARCH PROGRAM

I have listened to the questions with a great deal of interest. There is some unspoken debate here that deals with policy. I assume that your appearance here is primarily as a technical witness with respect to the feasibility of the program rather than a policy witness with respect to the policy of whether or not to develop a system.

Am I correct.

General ABRAHAMSON. I do have Dr. Kent Stansberry from our policy shop in case you want to ask him questions.

Senator McCLURE. A policy decision has been made that we will try to develop. I think a lot of the technical questions being developed and directed toward you are really for people who disagree with policy rather than disagree with the program being developed under it.

I am a little disturbed, as some others are, that we have decided to go into an extensive long-range research program rather than try to develop some near-term applications. The United States first discriminated a ballistic missile reentry vehicle in space by radar in 1958. The first U.S. intercept of a reentry vehicle occurred in 1962; 1962, not 1984.

If we could do those elements of ABM defense at the very beginning of the ballistic missile era, why do we plan to research for 20 years before we have some application?

General ABRAHAMSON. The kind of time lines that I have envisioned are not research for 20 years. There are folks who have inferred that is what it might take. We really saw the research program as about a 5-

year program when it was more robustly funded, it might be 6 or so now.

Senator McClure. Before applications or before decision?

General Abrahamson. That is to the decision point. Obviously, some of the technologies can mature earlier and if there were national decisions that said yes we should go earlier, I consider it my responsibility and one of the objectives of the program that I did not highlight or talk about in the effort or in my slide was to examine and be as prepared as possible to deal with a Soviet creep out of the treaty and if there is a national decision, to go ahead.

Obviously, we are not trying to direct the money exclusively, or the majority of the money, into those near-term applications.

Senator McClure. This is an ABM system, is it not?

General Abrahamson. Yes, sir.

Senator McClure. We speak of it as though it is something totally new. It is an ABM system.

General Abrahamson. That is right.

Senator McClure. A different kind of ABM system, but an ABM system.

General Abrahamson. That is right.

SOVIET VIOLATIONS OF ABM TREATIES

Senator McClure. As such, we are bound by a treaty negotiated over 20 years ago that had an ancillary agreement which was the ABM Treaty. Despite the fact that the ABM Treaty gave us the right to develop one system, we have not chosen to do so.

General Abrahamson. That is correct.

Senator McClure. The Soviet Union not only chose to do so, they are also developing further ABM systems, more widespread systems, in violation of the treaty.

Is that not correct?

General Abrahamson. That is correct, sir.

Senator McClure. In spite of the fact they have developed and deployed an ABM system and in spite of the fact they are in violation of the treaty, expanding that system and its capabilities, we are still electing to confine our activities to those which are not prohibited by the treaty which they violate.

Is that not correct?

General Abrahamson. That is correct, sir.

Senator McClure. I hope my information is correct; I believe it is.

SOVIET OPEN MASS PRODUCTION LINES

Do the Soviets have open mass production lines for the flat twin radar and ABM three interceptors?

General Abrahamson. Yes.

Senator McClure. Do the Soviets have open mass production lines for SAM–5's, SAM–10's, SAM–12 radars and interceptors?

General ABRAHAMSON. Yes, sir.

Senator MCCLURE. Those are ABM systems, are they not?

General ABRAHAMSON. Correct.

Senator MCCLURE. They have tested radars in an ABM mode in violation of the treaty, have they not?

General ABRAHAMSON. Yes.

KRASNOYARSK RADAR

Senator MCCLURE. The Krasnoyarsk is a battle management radar, is it not?

General ABRAHAMSON. Yes, sir.

Senator MCCLURE. That is in violation——

General ABRAHAMSON. The Krasnoyarsk radar is not on line yet at this point in time.

Senator MCCLURE. I understand that.

General ABRAHAMSON. Until it comes on line, I think we have some difficulty saying that. We cannot find any reason for it to look any different. With its size, it may have very substantial capability.

Senator MCCLURE. I think our official position as a country and in public statements released by the administration is that it is a prohibited type of radar installation.

General ABRAHAMSON. That is correct, sir.

Senator MCCLURE. It is prohibited as a battle management radar under the ABM Treaty, is it not?

General ABRAHAMSON. It is prohibited under the ABM Treaty in terms of its location, sir.

Senator MCCLURE. And its location is such that it would be capable of being battle managed?

General ABRAHAMSON. Yes, sir.

COST EFFECTIVENESS OF DEFENSE SYSTEMS

Senator MCCLURE. The reason I mention that is that it seems curious to me that a number of people in our country are still critical of our attempting to catch up to what the Soviet Union has been doing for years.

I understand the cost-effectiveness argument, I believe I can state it correctly, that if it costs $10 million to destroy a city and $100 million to defend a city, we ought to have the capacity to destroy 10 of their cities rather than defend one of ours.

I do not know what the relative value of human life is and I do not know how you make a cost-effectiveness study that says it is better to kill 10 of their cities than to defend one of ours. Some people are making that calculation today.

I wonder where we have gotten in terms of moral sensitivity in this country over a period of time, just a lifetime?

I remember President Reagan saying at one time that as a college student, they had debated whether or not they would obey an order to drop a bomb on a defenseless civilian population from a bomber. That was in the 1920's and 1930's that we were debating those questions because World War I had not yet gotten us to that point.

World War II pushed us beyond the point of debating whether or not it was moral to involve defenseless civilian populations. Now we are debating the cost effectiveness of destroying tens of millions of defenseless civilians because it is more cost effective to destroy them than it is to defend them.

Somehow we have to get back to the question of whether or not it is moral for us to pursue a defensive strategy that means killing or holding hostage tens of millions of foreign civilians. That seems to be almost totally missing in this debate.

Yet somehow to me that is the central part of the debate that we must bring to the American public and to our deliberations.

General, I have some questions with respect to strategic materials. I think you will agree that beryllium is essential. I think you will agree indeed we are very vulnerable on that as well as strategic materials.

I will submit those questions for the record for response in the record.

I thank you for your testimony. I may have some other questions also to submit.

General ABRAHAMSON. Thank you, Senator.

Senator STEVENS. Thank you very much.

SOVIET CONCERN FOR SDI PROGRAM

General, those of us who participate in the arms control observer group, I think at least I state for myself as one of the members of that, have come to the conclusion from our conversations with the Soviets in Geneva that the only single item in our defense budget they are concerned with, total absorption and they are totally concerned with, is SDI.

I have gone back there enough, for the sixth time just recently, and met with the Soviet ambassadors as well as ours.

Can you tell us any more about your meeting with them?

General ABRAHAMSON. Sir, that particular meeting was intended to be, I think, an attempt to measure whether or not they would arrive at a point of candor about their program. In that sense, it was intended to be reciprocal.

Therefore, we presented, and I had an assistant presentor there, an unclassified version of both what it was that we were trying to do and a brief discussion of technology. We were trying to assure them that indeed it is not an offensive program. It is intended to be optimized for defensive use.

Each of the members of the Soviet delegation, which included a number of generals as well as diplomats and others, had the opportunity to ask one or two questions and I answered them to the best of my ability.

I know of no equivalent offer by the Soviets to discuss their program.

SENSOR FUNDING

Senator STEVENS. I have some questions, too, about some of the decisions you have made. I note, for instance, that you have decreased the sensor allocations as a result of the reductions in the last budget process, but now you seek to rapidly accelerate sensor funding in the 1987 allocation.

Assuming that there is a reduction by the Congress of this item in the budget process, have you set your priorities now so that sensors will stay in or will they come down again?

General ABRAHAMSON. Obviously, it depends on how much the Congress decides that they would be forced to cut. I would have to go back and reexamine those priorities.

One thing is that we have now, I think, a much more definitive plan in terms of the sensor activity. One of the reasons that the cost has gone up again is that we now have several shuttle flights that are defined and we have made some of the first source selections in the competitive arena looking at some of the sensor activities that would be required as well as the pointing and tracking activities that would be required.

DEFENSE BUDGET

Senator STEVENS. We can project fairly well what the budget process is going to do. There will be roughly a 20- to 25-percent cut in this item in the budget process. I predict to you that the appropriations process will not reduce that. If I have anything to do with it, it will not be reduced.

I think the President of the United States, no matter who he is, if the President were of another party I still believe the President of the United States has a right to set a No. 1 priority on a percentage of the defense funds.

This is approximately 1.5 percent in terms of requested level. I do not know what it will be in the final amount. Probably about the same percentage of the final amount of the budget.

I think from his perspective in terms of foreign policy and particularly in dealing with the arms control process at the negotiations going on in Geneva and our relationships that have been created through our process of full disclosure and negotiation with the allies means that we must listen on this one.

I would urge you to work on the budget process. God willing and the Congress remaining the same, I think we will provide the funds that are necessary, keeping in mind again now we are still dealing totally with 6.3 funds, technology and development funds; is that right?

General ABRAHAMSON. Yes, sir. I think it is probably worthwhile to point out——

RESEARCH FUNDING FOR SDI

Senator STEVENS. Let me pin this one down for sure. There is no development money in this budget, is there?

General ABRAHAMSON. No, sir. It is 6.3a type of funding. Actually, some of it is 6.1 research. Some of it is 6.2 research. It is a misnomer that it is over in 6.3a.

Senator STEVENS. There is no development money in this budget?

General ABRAHAMSON. That is correct. I would like to point out that some of the kinds of things that we are doing are researching for production. Remember my point in trying to understand the cost of various elements.

Senator STEVENS. It is still research, there is no production money or no development money yet.

General ABRAHAMSON. That is correct.

Senator STEVENS. Under those circumstances, I think it is highly important to make sure everybody understands that because we do have some dialogue with our allies and others if we ever cross that line, propose to cross that line.

We will have to wait to see if that day comes and what we do then. For now this is research money.

General ABRAHAMSON. That is correct.

Senator STEVENS. I believe the President of the United States ought to have the prerogative to say this is No. 1. He told me that personally this is No. 1. We listened to him last year and I tell you I think my good friend, John Stennis, and others feel similarly about the President.

SUPPORT FOR ADMINISTRATION POSITION ON SDI

The President, as Commander-in-Chief, ought to be able to tell us this is it as far as the defense budget is concerned. You have my confidence, I want you to know. As I said, there is obvious disagreement here and we must in this process allow that disagreement to be expressed and to give ample time for the people who oppose your point of view to come here before the committee.

We will also give ample time to go see what is happening and to talk with some of these scientists who seem to send back from time to time messages that are not quite understandable in terms of the overall context that they are presented.

I want to have the subcommittee have the opportunity to be in each one of these places where this research is concentrated. There are a lot more than five places, as you know. We will do that.

I commend you for making the decisions the way you have made them and for presenting the President's position in the manner that you present it. I am not sure where I am going to be if you come here and ask for development money now. Do not ever forget that.

In this phase we ought to know if it is possible and we ought, to the extent of our capability, develop this technology.

Senator Cochran.

Senator COCHRAN. Thank you, Mr. Chairman.

SDI ALTERNATIVE TO MUTUALLY ASSURED DESTRUCTION

General Abrahamson, I think that the work that you and those who are working with you are doing may be the most important activity at the Department of Defense today, because it certainly offers us as a country the hope that there may be an alternative to the madness of mutually assured destruction.

I think we ought to make every effort to find whether or not that alternative does exist and whether or not it can be utilized by us to provide hope for our country in the form of a feasible alternative.

In that connection, it worries me that you had to say that 25 percent of the funds that were allocated to this program for fiscal year 1986 have been eliminated, compared with the 4.3-percent reduction that was applicable to domestic programs.

Why is it that the Strategic Defense Initiative had to bear such a large portion of that burden compared with domestic programs and other activities of the Department?

General ABRAHAMSON. Sir, I cannot answer that. I can only say that we presented what we thought to be the highest priority effort in the Department of Defense. It had the support of the dedicated people at all of the service levels and certainly the Secretary and the President.

It was the Congress overall final judgment to cut the program by 25 percent.

Senator COCHRAN. You are not saying this was not part of the sequester order that took effect on March 1?

General ABRAHAMSON. No, sir.

Senator COCHRAN. Your 25 percent was the difference between the requested amount and the appropriated amount?

General ABRAHAMSON. That is correct, sir.

EFFECT OF SEQUESTER ORDER ON SDI

Senator COCHRAN. What impact, if any, did the sequester order that was effective on March 1 have on the Strategic Defense Initiative?

General ABRAHAMSON. Because we had the ability to make some judgments within the fiscal 1986 sequester, the SDI was exempted.

Senator COCHRAN. I am hopeful that the Congress will respond to the President's request in the way the chairman indicated. I share his view that we ought to make a maximum effort in this research area.

I think you are on to something. I think you are going to come up with a way that we can find an alternative to the strategic doctrine that we have to abide by now.

Let me ask you this. People may have overlooked the fact that in your prepared statement you refer to some advances that have been made in other research areas because of the investment our Government is making in the Strategic Defense Initiative. You mentioned medical research.

Aren't there other areas as well that you can say will benefit from the activities that are ongoing now?

GALLIUM ARSENIDE

General ABRAHAMSON. Yes, sir, I think that there are. Let me give you one example in the computer industry.

Nearly every nation that has an advanced technology capability is doing research in the next generation of materials for computers. The next generation is generally conceded to be material called Gallium Arsenide. We now have, because of the funding in this program for that, two automated production lines for Gallium Arsenide operating in the United States.

There are many, as I indicated, batch lines and efforts amongst our allies and in many other areas. The only other country in the world that I at least suspect has automated production lines for Gallium Arsenide circuits is Japan.

BUSINESS AND UNIVERSITY INPUT INTO RESEARCH PROJECTS

Senator COCHRAN. At the beginning of this program there was an opportunity for universities and industry to make suggestions or file with your office unsolicited proposals or suggestions about areas that ought to be explored as a part of this research project.

Since then, however, I am told that it is more and more difficult for those who may have suggestions to crank that into the system so that they are carefully considered by those who are working with you.

Is there a problem with the existing organizational structure that would make it difficult for somebody to have their suggestions reviewed, to have their proposals carefully assessed?

General ABRAHAMSON. I certainly hope not, sir. What we have established is that we have set aside funding for what we call innovative science and technology which is primarily for universities and small businesses. This is a very powerful combination of tying university researchers with some small business entrepreneurs to provide for some of these technologies.

We have conducted that program, as we are allowed to do under the law, classified as 6.1 research which appears under a broad area announcement. It is not an unsolicited proposal. We have asked for this broad announcement to allow various universities to present their research proposals in certain categories pertinent to technology.

We have unfortunately only been able to fund about 20 percent of the really attractive ideas that have come in. Many of them are lower priority and perhaps not as applicable to what we are trying to do.

So, that means that there are a large number of disappointed people out there. I think that is what you may be hearing, some of those disappointments, that we cannot fund as much as there are really good ideas to proceed with.

Nevertheless, we are still trying to maintain a generous program in this area. In fiscal 1986 we are aiming, for example, at $50 million exclusively for university-type research in this innovative area.

Now, this is not the total of university research. In fact, it is substantially more than that. Obviously, how much we will be able to have of that grow in 1987 will depend on what our final outcome is.

Our initial plan was to allocate $80 million for that. Now, those are very generous programs, but they have some incredible payoffs as well.

INDEPENDENT THINK TANK RECOMMENDED

Senator COCHRAN. I read in this morning's newspaper that you testified yesterday on the House side before a subcommittee and suggested that you might establish an independent think tank organization for unbiased research to give your shop an opportunity to hear from others that may not be motivated by the enticement of an official contract or further contracts in later years.

Is this going to be simply another layer of research that is duplicative or is too costly?

Do we really need this in the context of the strain on the budget that we have now? Have you looked at that?

General ABRAHAMSON. That is a valid question, sir. If you recall in my answer to Senator Proxmire and some others about the progress and why it is that we have been able to make some selections and make some of these decisions with a base of knowledge rather than just kind of being arbitrary about the technologies, we have done a great deal of work in systems studies in making systems tradeoffs.

Now, the way we proceeded with doing that is to extract a dual benefit. I wanted to educate as large an amount of our national industrial capability as possible into our requirement and the difficulties of this task.

At the same time, I wanted to get different ideas from a large number of companies. So, we invented a kind of new procurement concept which I call a horse race, and it truly is that. The horse race puts a premium on people working hard and producing good efforts quickly.

The way I have characterized it is that the ones that are slow get shot in midstride and they get taken off the effort. This has been effective in getting a first look at the architecture, a first look at the technical tradeoffs.

There has been a fairly significant budget in that, but as we go forward, we will be decreasing that and if this think tank—a better way of describing it really is an architecture and tradeoff support activity that will build up so that there will not be a net increase in the budget. In fact, I am hoping for a decrease by having this.

The important thing is that it will have certain characteristics, the ability to ensure that they can go into real depth and they can examine different contractors' proposals, even proprietary proposals, and they will be willing to discuss those things with an organization that is not working with their competitor somewhere and is dedicated only to the SDI.

Hopefully, there will be a large number of dollars, a huge amount of money that will be swung on small technical decisions here. I believe that in the long term the Nation really needs an organization that will be absolutely squeaky clean and that they have no conflict of interest at all for some of these technical support items to our program office.

They are not another level of research. They are doing the system tradeoffs. The system architect perhaps is a better way to describe what that might be.

Senator COCHRAN. I appreciate your responses and congratulate you again on the excellent work that you and those working with you are doing.

CAPABILITY OF SHUTTLE TO MEET NEEDS OF DEFENSE AND SPACE COMMUNITY

Senator STEVENS. I have not used up my total time. Let me ask one question I should have asked and it relates to primarily a problem we have in our appropriations field.

I understand that you are now reviewing with the Space Flight Center the whole question of the transportation requirements for SDI as they relate to the shuttle operation.

General ABRAHAMSON. Yes, sir.

STATUS OF SHUTTLE FLEET

Senator STEVENS. There obviously are going to be some substantial requirements for your organization if you get to that point. I would like to know, I think the committee would like to know, whether you have been able to assess the existing shuttle fleet and determined whether that fleet will be able to meet the needs of the defense community and the space community and your needs as they develop?

Have you reached that point yet?

General ABRAHAMSON. Yes, sir. If there were a decision for SDI to go forward into development and the deployment phase and there were, as one can see, a substantial part of the effort that would include space vehicles, our judgment at this point is already that the Nation does not have enough space transportation, particularly of the low-cost variety, that I think we need for an SDI system as well as all of our defense and civil and scientific needs.

Senator STEVENS. Are you going to be involved in that reassessment, then?

General ABRAHAMSON. Yes. There is a national study that is going on directed by the President and that one is funded about a third from our program, a third from the Air Force acting as representative of the Department of Defense for all space launches with the exception of our requirements, and NASA.

So, that study is ongoing and should be in a position where we will have good preliminary conclusions by this summer. The intent of that, of course, is that we can first wisely make investment in research in the systems that will eventually bring down the cost of space transportation.

When it is an appropriate time to make a decision, yes, we should go ahead on any one of those systems or perhaps several of those systems, that could be made based on a solid foundation of knowledge.

Senator STEVENS. Senator Andrews.

Senator ANDREWS. Thank you, Mr. Chairman.

My apologies. I had a couple other subcommitttees before I came here.

General, I have listened to your testimony before. I think I understand the program. I want to ask one question that I think the general public is interested in.

RESEARCH FUNDS FOR SDI

All of the funds for SDI in this budget that is being requested by the President are funds for research, not for positioning in space; is that not true.

General Abrahamson. Let me make sure I understand what you mean by positioning in space.

It is all for research. I do not know what that is in opposition to research.

Senator Andrews. Because a number of people say that we do not need to place these units or these missiles or these rockets or these whatever in space at this time. That is not the argument.

I think we have to make crystal clear that what you are doing in the budget request you are making before us now is asking for basic research so that we can be more knowledgeable as a nation on whether indeed, and in fact, it will work to destroy other missiles so that we can back away from what we have been using as our national strategic retaliation that we incinerate tens of millions of people.

Quite candidly, I think it is human to say if they shoot at us, we will destroy their weapons rather than destroy them. It will make us sleep better nights. We are not putting the Star Wars scenario in space with this appropriation.

All you are doing is trying to get some information to decide whether or not it would be feasible. Is that not true?

General Abrahamson. That is correct, sir. I earlier commented on what I thought feasibility meant and some of the progress we have made in these areas.

Obviously, a substantial part of the research deals with the feasibility of space-based systems. But it is also important to point out that we are also dealing with the feasibility of ground-based systems as well.

For some reason, there is a misunderstanding and people have focused rather entirely on this space-based side of this. Actually, many of the concepts involve ground basing. We are not doing any of that. We are researching those concepts, but it will include both space basing and ground basing.

SPINOFF BENEFITS FROM SDI RESEARCH

Senator Andrews. The information bank that you are assembling through this process is available not just for some space-based defense system, but also available to be shared with NASA, as you say, you are a one-third participant.

Also it will be used for further technical knowledge in transportation around this globe of ours.

General ABRAHAMSON. That is correct.

Senator ANDREWS. That is all spinoff from the basic research you are doing?

General ABRAHAMSON. I think there will be many areas of spinoff. I have to point out what Vice President Bush said, that we did not go to the Moon to build Teflon for frying pans, but, nevertheless, we did get Teflon out of it. Our focus is on the military program.

There will be very appreciable spinoffs for other military programs as well. There is no question about that, in conventional defense, in other space systems, in other ground-based systems.

There is just no question about that. Furthermore, I believe that we will indeed be pushing for technologies that will have civil applications as well.

Senator ANDREWS. I am accurately stating that before any of this military technology is stationed in space, there will be many subsequent votes in the Congress. All we are doing now is gaining knowledge so that we will know whether it is feasible or not feasible to move ahead in this particular area.

General ABRAHAMSON. Yes, sir, that is correct.

Senator ANDREWS. Thank you, Mr. Chairman.

Senator STEVENS. Thank you.

Senator Proxmire, do you have another question?

FEASIBILITY OF SDI TECHNOLOGY

Senator PROXMIRE. Yes, I do. I would like to ask the General to elaborate a little bit on his response to Senator Rudman. Senator Rudman asked the question. He said what you are telling us is, that this is feasible, given time and given money.

There is no question that the technology is basically feasible. Isn't there another dimension that really challenges that? Doesn't it depend on dynamism, the effectiveness of the technological improvements in offensive missiles?

There is no question in my mind at all that 20 or 30 years from now you can put together and deploy something that would stop the present Soviet Union's ICBM's. Twenty or 30 years from now they will not have those ICBM's. They will have missile systems designed precisely to penetrate whatever defensive system we put up. That is what they will work toward.

General ABRAHAMSON. Yes.

Senator PROXMIRE. Can you assure us they will be feasible against whatever conceivable kind of offensive arsenal the Soviet Union is able to put together?

General ABRAHAMSON. There is no such thing as being able to say any conceivable kind and you understand that. Therefore, I think the way you have stated the question is perhaps putting the wrong perspective on it.

We are not working only to try to see if we can find counters to today's technical systems. As I indicated earlier, we are trying to carry both the research, our analysis and our extrapolations of what they might do far enough into the future that we can make a good solid judgment about what is practical and where they might go and we are looking for these fundamental areas where it is clearly advantageous to have a defense.

My conclusion, quite differently from many of our critics, already is that the previous assumption has been that the offensive ballistic missile, the nuclear armed ballistic missile and in some cases the conventionally armed ballistic missile, is omnipotent; we can never stop it.

Unlike any other weapon in history, it cannot be countered. I believe that we have already seen enough about that that we can say that that is nonsense.

Senator PROXMIRE. I agree with that wholeheartedly. I do not think you can take the position that 20 or 30 years from now, given this hard-driving arms race, the Soviet Union will not have an offensive nuclear system or some system even more devastating than nuclear, that will be able to penetrate whatever star wars we put up.

ARMS REDUCTIONS BY ARMS TREATIES

That is why it seems that stopping the arms race by arms control has to be by far the best answer, trying to stop the arms race rather than to say that we are going to put up an offensive system that will obviously promote an offensive system on their side and it goes on and on with more spending, less and less stability and constantly increasing danger.

General ABRAHAMSON. Senator, I understand exactly what you say. I would only ask what I think is the question that is so important. It is easy to assert that the right answer is stop the arms race. I think the real question is how.

Senator STEVENS. The real question is whether or not Congress will meet its constitutional responsibilities to provide for the common defense of this country so long as there is a threat, General.

General ABRAHAMSON. Thank you, sir.

DEVELOPMENT OF LAYERS OF INVULNERABILITY

Senator PROXMIRE. Let me ask this question. It seems to me that most people, not all, but most people, think that defending the population of our cities is the least likely outcome of the SDI. The most likely outcome is that it will be able to perform a very useful purpose in protecting our weapons, particularly our weapons that are stationary, weapons on the ground or weapons in submarine pens, weapons on bomber bases, and so forth.

Now, when you look at weapon systems that we now have deployed, 50 percent in submarines, the Secretary of the Navy sat where you are sitting here a year ago and told us that not only are they invulnerable, they will be increasingly invulnerable as time goes on.

We have this colossal, tremendous ability to hit the Soviet Union, a deterrent that does not need SDI protection. The same thing can be said for many of our submarines at sea at all times. We have the same kind of relative invulnerability for our bombers. They are in an enormous air envelope.

There is no way the Soviet Union can ever sink every one of our submarines and bombers. Then we are going to land-based mobile missiles, single warhead.

How many layers of invulnerability do we try to develop? The one kind of weapon system SDI would protect would seem to be the MX, a land-based, stationary missile, that perhaps SDI can provide a useful protection for.

Engaging in something enormously expensive for that single defense seems to me to be too limited a target to justify.

General ABRAHAMSON. Your full point rests on the assumption in that last statement and the last statement was that you assume, or many assume, that the only real practical outcome of the Strategic Defense Initiative is indeed defense of those kinds of systems.

What I have tried to indicate is that our research program is not aiming exclusively at that kind of thing. In fact, the primary objective is exactly what the President laid out and that is a broad area of defense that will defend not only those things, but more importantly our people, and not let us stand in such a position that we can be threatened and in the process of a crisis or a threat or a series of threat-crisis-threat-crisis suddenly end up in this terrible time when the Soviets think that they must indeed strike first.

Remember that is what their doctrine is.

DELAY OF DEVELOPMENT DECISION DATE

Senator PROXMIRE. It seems that the large spending increases you are requesting are driven by the early 1990's development decision date. By 1990 you may have George Bush as President of the United States. He may be favorably disposed.

What is sacrosanct about that date? Why cannot you accept some slippage in return for a lower budget and possibly less criticism of large percentage increases?

General ABRAHAMSON. There is a pace on various programs. There is a natural growth and pace for research efforts of different kinds. It is possible to delay some of these things.

It is also important when you consider delay, although we do not have an IOC, this is one of the things that is difficult as we begin to say yes, we have a time scale that we are working on. I do not have a particular date.

On the other hand, we do have some dates on the Soviet side. The Soviet side does have the ability and will have the ability to creep out or to make decisions that will allow them some very effective defense, much earlier than the kinds of effective defense that we would want to have and you have seen some of that intelligence and it is very real.

If you would like, we will be happy to provide additional information.

Now, there is also a general pace of programs that you must have a certain amount of effort or you will never get there. I can assure you I know that from terrible experience in an important program long ago and that was the manned orbiting laboratory.

We were always year after year when it got to the point you had to have peak funding—I am only giving you a subjective answer, but it is a real answer and understood by technologists who know you have to spend a certain amount of money across a broad front.

MANNED ORBITING LABORATORY

In the manned orbiting laboratory in the years 1967, 1968, and 1969 the request was always cut by about the same amount that we are having ours cut, about 25 percent. Unfortunately, you were always 3 years from launch.

What happened, obviously, was that we could not progress. We were not getting the dollar-for-dollar efficiency out of the expenditure and in fact after several years of recognizing that, the program was canceled.

Senator PROXMIRE. My time is up. I just must say that there has never been a program—I have never seen programs that have had this colossal increase percentagewise. You are asking for a continued increase at a rate that other Secretaries of Defense have said there is no way we can spend money that fast on a research program efficiently.

My time is up.

Senator STEVENS. Thank you. We will have other hearings. I appreciate your courtesy, General. It is nice to see you. We intend to see a lot of you this year.

General ABRAHAMSON. Thank you, sir.

SUBMITTED QUESTIONS

Senator STEVENS. The committee has additional questions for the record which will be inserted at this point.

[The following questions were not asked at the hearing, but were submitted to the Department for response subsequent to the hearing:]

QUESTIONS SUBMITTED BY SENATOR JOHNSTON

QUESTION: Your budget request is well over $5 billion if you include the DOE request of $603 million for SDI related technologies. When do you project SDI will be in service or fuly operational? Won't it be about 2 decades from now?

I have an unclassified chart here entitled "SDI Transportation Timeliner". It shows there is a development decision in the early 1990's, deployment decision in the late 1990's, and SDI goes into service about 2005 after a 7 or 8 year deployment.

ANSWER: Our goal in the research phase of the SDI program is to provide the technical basis for an informed decision in the early 1990's on whether to proceed with full scale development of a ballistic missile defense system. The operational date of an SDI system will depend upon the decisions made and emphasis added to the program during this decision phase. Certain technologies may prove to be more readily employable than others thus accelerating the expected date of a decision on deployment. It is not possible at this time to provide a schedule as to when, or even if, a deployment would occur.

QUESTION: The DOD provided Congress its outyear projections for ABM research and this projection which was made just prior to the President's Star Wars speech showed that this Administration would request $2.546 billion in FY 1987 for ABM related research. In fact you are asking double that. What happened other than the President's speech to require a doubling of your budget?

ANSWER: The DOD forecast made just prior to the President's speech was based on a general ABM research program not geared toward the specific research goals set out in SDI. The President's speech changed ABM research status to a more focused program to determine the technical feasibility of moving to a deterrent posture based increasingly on defenses which threaten no one, and ultimately rendering offensive ballistic missiles obsolete. The technology development pace is oriented towards providing the information necessary to make informed decisions concerning the future of strategic defenses in the early 1990's.

QUESTION: Given the importance of the boost phase defenses and the problem of making them survivable, how will you defend them against Soviet space mines that might be parked in the same orbit as your key sensors.

ANSWER: Examination of possible Soviet countermeasurs against defenses is an important part of our research. If the object is really a space mine then it will have no propulsion. In that case a change in orbit will cause it to seperate from its intended target. If the space mine is to follow its intended target then it must be either an autonomous space craft, which is as complex as its target and probable very expensive, or command guided and hence subject to jamming. If the device is non-nuclear, it must move to attack and it can be seen and countered. Making the device nuclear would present the Soviets with very significant command and control problems as well as significant political liabilities. It is far more likely that they would use ground based methods of attack.

QUESTION: The congress has tripled your budget since 1984 ($.99 billion to $2.76 billion, excluding DOE) but it is still short of your budget requests. In the last two years Congress appropriated $1.3 billion less than your requests for those two years. How is it that you are continuing to hold to an eary 1990's development date when your budget is $1.3 billion less than what you said you had to have?

ANSWER: The Strategic Defense Initiative Organization has been forced to make decisions regarding certain major technologies sooner than we would have liked. Budget reductions forced a selection based on perceptions of concepts' strengths and weaknesses. Alternative technology research has not been funded at a level necessary to minimize program risk. The reductions have forced higher program risk and pursuit of an austere research program.

QUESTION: A study released by the French Ministry of Defense last week is reported to conclude that a defense like SDI could be penetrated and perhaps defeated by even a medium power like France through a number of technological steps. The Delpech study, led by Jean-Francois Delpech, director of France's National Scientific Research Center, found that a space defense system would itself be vulnerable both to an adversary system and ground-launched ASAT systems. The Delpech study further asserted that even

> "a medium power like France could probably acquire the means to partialy neutralize a space defense system, or at least to degrade its performance sufficiently to ensure the penetration of its own ballistic missles."

If this is what France believes it could do, couldn't the Soviet Union, with about 20 times as many missiles and 80 times as many warheads as France and a far larger military and R&D budget, counter SDI even more effectively?

ANSWER: We have not had an opportunity to review the French report. However, to date our studies have not found such conclusions to be warranted.

QUESTION: At the hearing I asked you whether the pop-up x-ray laser could be used effectively against the Soviet fast-burn booster in the boost phase. I believe you indicated that it could, but you seemed to be talking about use of the pop-up x-ray interceptor not against the boost phase, but against a Soviet fast-burn ICBM in the midcourse or at least the post-boost phase.

a) Isn't it true that for a pop-up x-ray interceptor to destroy a Soviet fast-burn booster in the boost-phase would require an extraordinary increase in the specific impulse of the best known rocket fuels available today?

b) Would we have to forward-base the interceptors outside the continental U.S.?

c) What would be the required increase in the specific impulse for a pop-up x-ray interceptor based in the continental U.S. to destroy a Soviet fast-burn booster in the boost phase?

ANSWER:

a) The ability of a pop-up interceptor to destroy a fast-burn booster in the boost-phase would be a function of where the x-ray interceptor is based, the launch warning time and the specific impulse of the interceptor. For most basing locations the time lines are too short to destroy the first few fast burn boosters for any reasonable specific impulse launched. However, Ballisitc Missiles in their midcourse, or possibly post-boost phase, could be destroyed.

b) We are still in the process of analyzing the military utility of a pop-up x-ray laser interceptor, but preliminary indications are that forward-basing outside the continental U.S. would be required to achieve boost or post bost phase intercept.

c) As stated in the above, answer we do not see an application for a pop-up x-ray laser interceptor based in the CONUS against Soviet launched fast-burn booster in the boost phase.

SUBCOMMITTEE RECESS

Senator STEVENS. The subcommittee stands in recess until 10 o'clock, Wednesday, March 12, when we will have testimony on the defense acquisition policy.

[Whereupon, at 12:30 p.m., Wednesday, March 5, the subcommittee was recessed, to reconvene at 10 a.m., Wednesday, March 12, 1986.]

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1987

WEDNESDAY, APRIL 9, 1986

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 10:50 a.m., in room S-407, the Capitol, Hon. Ted Stevens (chairman) presiding.

Present: Senators Stevens, McClure, D'Amato, Rudman, Proxmire, Johnston, and Sasser.

DEPARTMENT OF DEFENSE

STRATEGIC DEFENSE INITIATIVE ORGANIZATION

STATEMENT OF LT. GEN. JAMES A. ABRAHAMSON, DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

STRATEGIC DEFENSE INITIATIVE

OPENING STATEMENT OF SENATOR RUDMAN

Senator RUDMAN [presiding]. By consensus, which the chairman may not agree with—we hope he does—we are going to convene the hearing. I know the chairman was most interested in having this session in order to give members of the committee an opportunity to have detailed questions which could not be answered in open session.

I guess what we would like to do, General Abrahamson, is to go ahead with whatever presentation you have and then we will have questions.

OPENING AND SUBMITTED STATEMENTS OF SUBCOMMITTEE MEMBERS

Before proceeding, we will place the various statements in the record.

[The statements follow:]

OPENING STATEMENT OF SENATOR STEVENS

Good morning. We are here today to continue our review of the fiscal year 1987 budget request for the Strategic Defense Initiative. This is the first of three additional hearings we will hold on the Strategic Defense Initiative.

On March 5 the subcommittee heard testimony on the Strategic Defense Initiative from Lt. Gen. James Abrahamson, Director of the Strategic Defense Initiative Organization in open session. However, because of our desire to go into greater technical detail as to the major components of the SDI Program, we have decided to hold this closed hearing to permit questioning on classified material. This will enable the subcommittee to investigate a wide range of technical and systems issues that we would be unable to address in open session.

We have also scheduled outside witness hearings to hear testimony from an impressive group of former U.S. Government officials on both sides of the SDI issue.

With us again today to discuss the President's fiscal year 1987 budget request for the Strategic Defense Initiative is Lt. Gen. James Abrahamson, Director of the Strategic Defense Initiative Organization.

General Abrahamson, welcome back to the committee. Your entire statement will be placed in the record at this point. Since we received a lengthy presentation on the SDI Program from you at the March 5 hearing, please summarize your prepared remarks so that we may have ample time for questioning.

PREPARED STATEMENT OF HON. ALFONSE D'AMATO

U.S. Senator From New York

Mr. Chairman, I thank you for holding these additional hearings on the Strategic Defense Initiative, and I thank General Abrahamson for agreeing to come before this committee once again.

SDI continues to be a controversial and devisive national security issue, as well as a budget issue. The administration has requested $4.8 billion for SDI for fiscal year 1987, more than a $2 billion increase over this year's appropriated level. Although I am a strong supporter of the Strategic Defense Initiative, I fear budget realities will prevent full funding of this program.

Cost is only one of the major issues affecting congressional review of SDI. Many critics are concluding that SDI is infeasible. I believe that such conclusions are premature. Not to long ago, the Under Secretary of Defense for Research, Development, Testing, and Evaluation stated before this committee that the United States holds a firm, qualitative technological edge over the Soviet Union. It is essential that the U.S. exploit this advantage; SDI research does just that.

Exploiting our technological advantage is only one reason for the importance of SDI. The Soviet Union is very active in this area of research. The Soviet Union has the world's only operational antisatellite capability, as well as the only operational antiballistic missile system. The U.S.S.R. is actively developing and modernizing its defenses, including air defense and surface-to-air missiles. The Soviet Union now has a clear advantage in strategic defense that offers Moscow an increasing ability to respond effectively to the retaliatory forces of our Nation and our allies.

The SDI program is a prudent response to a very active Soviet research and development program. The U.S. pursuit of SDI does not, and will not, violate our treaty obligations. The ABM Treaty permits the kind of research envisioned under SDI. The question to proceed to deployment of an actual ballistic missile defense system will not arise for several years, and only after SDI research has determined that such defenses are both feasible and affordable.

The large price tag of SDI and its controversial nature will continue to require our diligent and dedicated attention. I commend the fine work you have done thus far, and I look forward to working with you on this important initiative.

Thank you, Mr. Chairman.

PREPARED STATEMENT OF HON. LAWTON CHILES

U.S. SENATOR FROM FLORIDA

General Abrahamson, we all appreciate the opportunity to have you with us here this morning to discuss in closed session the progress and challenges ahead in the SDI. First, I would like to briefly comment on the staff study compiled for myself, Senator Johnston, and Senator Proxmire. I want to make it clear that this study was not designed to be a critique of you or the SDI. No program manager in history has faced the immense challenges of physics and engineering that you face in the SDI. This is not a Manhattan project or an Apollo program. This challenge is much greater because as one scientist recently observed, "The Moon did not try to avoid our spacecraft or shoot back."

The staff study pointed out that in a short time you have developed a vital and centrally managed program. It also acknowledged that you have made real progress, especially in the area of directed energy weapons. Most importantly, it asserted that your work has resulted in a broad and bipartisan consensus to conduct a robust research effort.

However, the report also cited scientific concerns over very difficult problems that lie ahead and indicated that Congress address key questions on the pace and direction of the program. The critical nature of the boost-phase intercept, survivability of space-based assets, mid-course discrimination of an expanded Soviet threat, and space-based logistics are all questions with no apparent near-term answers. Two problems that I hope you will comment on this morning are what you are doing to address the concerns raised by the Eastport study group of computer experts and how we are handling allied participation in this effort. It is my understanding that your classified data sheets argue with the Eastport study that $189 million in increased funding will be required for battle management computers because the Fletcher study significantly understated that requirement. I hope you will go into some detail there.

On allied participation, I would like to hear from you what effort we are making to gain burden-sharing agreements from our allies on the SDI. It seems to me that if our allies are going to be allowed to compete for SDI contracts they should make some contribution to the pot.

PREPARED STATEMENT

General ABRAHAMSON. We have, of course, submitted a more detailed and publishable statement on an unclassified basis.

Senator RUDMAN. That statement is included in the hearing. You may proceed in any manner you wish.

General ABRAHAMSON. I am going to refer to this statement at this point. It is obviously available to the committee and for the record.

[The prepared statement follows:]

STATEMENT ON

THE STRATEGIC DEFENSE INITIATIVE

BY

LIEUTENANT GENERAL JAMES A. ABRAHAMSON
DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

THANK YOU MR. CHAIRMAN FOR THE OPPORTUNITY TO AGAIN APPEAR BEFORE YOUR COMMITTEE. I WOULD LIKE TO TAKE THE OCCASION OF THIS FOLLOW-ON APPEARANCE TO EXPAND UPON MY FIRST STATEMENT WHICH OUTLINED THE STRATEGIC ENVIRONMENT WE ARE NOW FACED WITH AND EFFORTS BY THE SDIO TO DEVELOP A STRATEGIC DEFENSE ARCHITECTURE. TODAY I WOULD LIKE TO PRESENT YOU WITH A MORE DETAILED EXPLANATION OF THE SDIO PROGRAM ELEMENTS. FISCAL YEAR 1985 WAS A CHALLENGING YEAR FOR THE STRATEGIC DEFENSE INITIATIVE ORGANIZATION (SDIO). EFFORTS WERE MOST INVENTIVE AND INNOVATIVE, AND EVENTS MOVED QUICKLY. THE CHALLENGE AND MOMENTUM GENERATED NOW CHARACTERIZE THE FY 1986 PROGRAM. THE FOLLOWING THEMES MOST ACCURATELY DESCRIBE THE EARLY AND FORMATIVE YEARS OF THE SDIO:

O WE FORMULATED AN INVESTMENT STRATEGY DESIGNED TO PERMIT THE SDIO THE ABILITY TO ACHIEVE ITS GOALS RELATIVE TO VARIOUS PROGRAM NEEDS AND FISCAL CONSTRAINTS.

O NEW OPPORTUNITIES EMERGED AND SIGNIFICANT PROGRESS WAS SEEN EARLY-ON IN THE TECHNICAL PROGRAM, THUS PROVIDING THE ESSENTIAL FOUNDATION FOR MAJOR DECISION MAKING IN THE FUTURE.

O WE ALSO SAW IN THE EARLY YEARS AN INITIAL CONVERGENCE OF KEY CONCERNS AND ISSUES IN THE IMPORTANT NATIONAL DEBATE ON THE SDI.

AT THE BEGINNING OF FY 1985, THE SDI EFFORT WAS CONFRONTED WITH THREE BASIC TASKS. FIRST, WE WERE FACED WITH DEVELOPING CONTINUITY IN THOSE PROGRAMS INHERITED FROM THE MILITARY SERVICES THAT WERE APPROPRIATE AND RELEVANT TO THE INITIATIVE. SECOND, OTHER INHERITED PROGRAMS HAD TO BE TAILORED TO FIT THE NEEDS OF THE SDI ENDEAVOR. THIRD, IMPORTANT NEW PROGRAMS HAD TO BE INITIATED THAT EXPANDED AND ACCELERATED THE PRE-SDI EFFORTS IN BALLISTIC MISSILE DEFENSE AND RELATED TECHNOLOGIES. STUDIES THAT WERE DONE IN THE SUMMER OF 1983 PROVIDED A BASIC SKETCH OF THE PROGRAM, A WELL ESTABLISHED GOAL, AND AN INVESTMENT STRATEGY THAT PUSHED PROMISING TECHNOLOGIES ACROSS A BROAD FRONT.

ALTHOUGH BUDGET REQUESTS FOR FY 1985 AND FY 1986 WERE REDUCED BY THE CONGRESS BY ABOUT 25 PERCENT, SDIO PROGRAM ADJUSTMENTS WERE MADE WITHOUT CHANGING THE BASIC GOALS. HOWEVER, WE HAVE BEEN FORCED TO ACCEPT HIGHER RISKS AND MORE AUSTERE RESEARCH. THE SDIO STILL PLANS TO PROVIDE THE BASIS FOR INFORMED DECISIONS IN THE EARLY 1990s ON WHETHER OR NOT TO DEVELOP AND LATER DEPLOY A DEFENSE OF THE UNITED STATES AND ITS ALLIES AGAINST BALLISTIC MISSILES. THE SDIO'S MISSION IS TO PROVIDE THE WIDEST SET OF TECHNICAL OPTIONS THAT PROVIDE AN EFFECTIVE DEFENSE OF CRITICAL ASSETS, OF THE UNITED STATES AND HER ALLIES. THE SDIO SEEKS STRATEGIC DEFENSE OPTIONS THAT:

O SUPPORT A STRONGER BASIS FOR DETERRING AGGRESSION;
O STRENGTHEN STRATEGIC STABILITY;
O INCREASE THE SECURITY OF THE U.S. AND ITS ALLIES; AND
O ELIMINATE THE THREAT POSED BY BALLISTIC MISSILES.

TO ACCOMPLISH THE MISSION OF PROVIDING THE WIDEST POSSIBLE

RANGE OF TECHNICAL OPTIONS, THE SDIO HAS ESTABLISHED A PROGRAM WITH THREE BASIC BUILDING BLOCKS. THE FIRST BEING A TECHNOLOGY BASE PROGRAM THAT INCLUDES OVER 50 PERCENT OF THE SCIENTIFIC WORK OF THE SDIO. IT CONSISTS OF BASIC AND APPLIED RESEARCH ACTIVITIES WHICH FOSTER THE BIRTH OF INNOVATIVE IDEAS, PROVIDE THE CONCEPTUAL FRAMEWORK AND KNOWLEDGE TO PURSUE LARGE PROJECTS, AND ENHANCE OPPORTUNITIES FOR PROGRAM GROWTH.

THE SECOND EFFORT IS THE TECHNOLOGY INTEGRATION (PROOF OF FEASIBILITY) EXPERIMENTS THAT SHOW THE FEASIBILITY OF KEY TECHNOLOGIES. IN PROOF-OF-FEASIBILITY EXPERIMENTS RESOLUTION OF MAJOR ISSUES IS EMPHASIZED. IF THESE ISSUES ARE RESOLVED FAVORABLY, THERE COULD BE A SIGNIFICANT IMPACT ON THE SUCCESS OF BALLISTIC MISSILE DEFENSES OVER THE LONG TERM.

THE THIRD BUILDING BLOCK IS THE DEMONSTRATION OF CAPABILITES PROJECTS INVOLVING TECHNOLOGY THAT HAS BEEN DEMONSTRATED AS FEASIBLE AND IS READY TO BE INTEGRATED WITH OTHER SUBSYSTEMS TO ACHIEVE DESIRED PERFORMANCE LEVELS. THESE PROJECTS EMPHASIZE INTEGRATION OF CONSTITUENT ELEMENTS AND THE PERFORMANCE OF FUNCTIONAL TESTS TO BRING FEASIBLE TECHNOLOGY INTO ENGINEERING PROOF-OF-PRINCIPLE. (IT IS NOT NECESSARY TO TEST FULL DEFENSIVE CAPABILITY TO PROVE FEASIBILITY.)

THE ESTABLISHMENT OF AN INVESTMENT STRATEGY FOR THE SDIO BASED ON THESE THREE BASIC BUILDING BLOCKS HAS MAJOR IMPORTANCE. THE LARGE BUDGET REDUCTIONS IMPOSED BY THE CONGRESS HAVE FORCED THE SDIO TO CONTINUALLY REEVALUATE PRIORITIES. THE IMPACT OF BUDGET CUTS IS PERVASIVE AT A TIME WHEN TECHNOLOGY IS MOVING FORWARD QUITE RAPIDLY AND THERE IS A NEED TO EMPHASIZE CERTAIN TECHNICAL AREAS ORIGINALLY UNDEREMPHASIZED OOKED.

OUR CURRENT INVESTMENT STRATEGY REFLECTING EFFECTS OF THESE CUTS IS TO PROTECT THE TECHNOLOGY BASE, INCREASE THE EMPHASIS ON

PROOF-OF-FEASIBILITY EXPERIMENTS WITH INCREASED INVESTMENT IN HIGH RISK - HIGH PAYOFF APPROACHES, AND DECREASE THE NUMBER AND SCOPE OF CAPABILITY DEMONSTRATION PROJECTS.

THIS INVESTMENT STRATEGY GIVES THE U.S. THE LEVERAGE NECESSARY TO MAKE SDI WORK EFFECTIVELY AT A REASONABLE COST. IT IS NECESSARY TO MAINTAIN A CONSTANT VIGIL OVER THE PRIORITY SETTINGS BETWEEN TECHNOLOGY BASE AND PROOF-OF-FEASIBILITY EXPERIMENTS. THE SDIO PROGRAM CAN AFFORD NEITHER TO PURSUE "SCIENCE FOR THE SAKE OF SCIENCE" NOR TO PROCEED WITH RISKY EXPERIMENTS HAVING AN INADEQUATE TECHNOLOGY BASE.

AS A RESULT, THE FOLLOWING AREAS HAVE BEEN SELECTED FOR GREATER EMPHASIS IN ACHIEVING PROOF-OF-FEASIBILITY AT AN EARLY DATE:

- GROUND-BASED FREE ELECTRON LASER TECHNOLOGY INTEGRATION EXPERIMENT,
- SPACE-BASED NEUTRAL PARTICLE BEAM TECHNOLGOY INTEGRATION EXPERIMENT,
- SPACE-BASED KINETIC ENERGY TECHNOLOGY EXPERIMENTS, AND
- A TRACKING AND POINTING EXPERIMENT.

UPGRADING THESE EXPERIMENTS IN PROJECTS IS A NATURAL OUTGROWTH OF THE SDIO'S EMPHASIS ON CRITICAL PATH PROGRAMS. ORIENTED TO RESOLVING KEY ISSUES NEEDED FOR EARLY 1990's DEVELOPMENT DECISIONS, SUCH EXPERIMENTS PROVIDE A TIMELY, VISIBLE, AND UNDERSTANDABLE SET OF MILESTONES TO MEASURE PROGRAM PROGRESS AND ACCOMPLISHMENTS.

CURRENTLY, TECHNICAL EFFORTS ARE STRUCTURED INTO FIVE PROGRAM ELEMENTS:

- SURVEILLANCE, ACQUISITION, TRACKING, AND KILL ASSESSMENT

(SATKA),

- DIRECTED ENERGY WEAPONS (DEW) TECHNOLOGIES,
- KINETIC ENERGY WEAPONS (KEW) TECHNOLOGIES,
- SURVIVABILITY, LETHALITY AND KEY TECHNOLOGIES (SLKT), AND
- SYSTEMS ANALYSIS AND BATTLE MANAGEMENT (SA/BM).

IN ADDITION TO THE FIVE PROGRAM ELEMENTS, THE SDIO HAS ORGANIZED AN ACTIVITY TO PROMOTE INVENTIVE IDEAS. A FIXED FRACTION OF EACH PROGRAM ELEMENT IS SET ASIDE TO FUND PROMISING CONCEPTS. ACTIVITIES TO DEVELOP THESE PROMISING CONCEPTS ARE CHARACTERIZED BY HIGH RISK, HIGH PAYOFF, LOW COST RESEARCH THAT CAN BE PERFORMED ANYWHERE (LABORATORIES, SMALL BUSINESS, INDUSTRY, UNIVERSITIES) AND BY ANYONE. THE WORK INVOLVES UNCLASSIFIED FUNDAMENTAL RESEARCH. RESULTS, WHEN EVALUATED, WILL HELP CREATE NEW OPPORTUNITIES FOR ALL OTHER PROGRAM ELEMENTS.

SURVEILLANCE, ACQUISITION, TRACKING AND KILL ASSESSMENT (SATKA) PROGRAM

THE SATKA PROGRAM PROVIDES THE RESEARCH EFFORTS NECESSARY TO IDENTIFY AND VALIDATE VARIOUS SENSOR CONCEPTS. THESE SENSORS MUST PERFORM SURVEILLANCE, ACQUISITION, TRACKING, DISCRIMINATION AND KILL ASSESSMENT OF ENEMY BALLISTIC MISSILES FROM LAUNCH TO WARHEAD REENTRY AND DETONATION (BIRTH-TO-DEATH).

IN THE BOOST PHASE, SENSORS MUST PROVIDE RAPID AND RELIABLE WARNING OF ATTACK AS SOON AFTER LAUNCH AS POSSIBLE. ONE SUCH CONCEPT IS THE BOOST SURVEILLANCE AND TRACKING SYSTEM (BSTS). SINCE THIS FUNCTION IS ESSENTIAL FOR WARNING ASSESSMENT AND HANDOVER TO OTHER DEFENSE ELEMENTS, BSTS MUST BE HIGHLY SURVIVABLE TO DIRECT ATTACK DURING THE BATTLE AND ENDURE AFTER THE BATTLE IS FINISHED.

IN THE POST-BOOST AND MIDCOURSE PHASES, SENSORS MUST PROVIDE

ACCURATE AND EFFICIENT TRACKING AND DISCRIMINATION BETWEEN REENTRY VEHICLES AND LIGHTWEIGHT PENETRATION AIDS AND OTHER DEBRIS. MIDCOURSE SURVEILLANCE SYSTEMS MUST BE CAPABLE OF ACCEPTING TRACK FILES FROM BOOST PHASE SURVEILLANCE AND PROVIDE TRACK DATA FOR HAND-OFF TO POST-BOOST AND MIDCOURSE INTERCEPTORS AS WELL AS TERMINAL PHASE TRACKING SYSTEMS.

SIMILAR TO THE MID-COURSE PHASE, IN THE TERMINAL PHASE, SENSORS MUST PROVIDE EFFICIENT TRACKING AND DISCRIMINATION OF RVs FROM PENETRATION AIDS AND OTHER DEBRIS BASED ON RADIOMETRIC AND BALLISTIC INFORMATION. SYSTEMS MUST BE CAPABLE OF RECEIVING TRACK INFORMATION FROM MIDCOURSE SENSORS, TRACKING THE TARGET, PROCESSING THE DATA, AND PASSING COMMANDS TO INTERECPT VEHICLES.

SIGNIFICANT ACCOMPLISHMENTS (FY 1984-1985)

TECHNOLOGIES

o IN THE AREA OF INFRARED (IR) SENSORS, CYROCOOLERS HAVE BEEN DEVELOPED THAT ARE UNDERGOING LIFE TESTING THAT SHOULD INCREASE SENSOR PERFORMANCE.

o THE SDI RADAR DISCRIMINATION STUDY HAS BEEN COMPLETED.

o IN THE AREA OF SIGNAL PROCESSING, GaAs PILOT PRODUCTION LINES ARE NOW OPERATIONAL. A FIVE NODE PROTOTYPE ADVANCED DISTRIBUTED ONBOARD PROCESSOR (ADOP) WAS DELIVERED AND INSTALLED IN HUNTSVILLE, ALABAMA.

EXPERIMENTS

o REQUIREMENTS DEFINITION FOR BOOST SURVEILLANCE AND TRACKING SYSTEM (BSTS) AND SPACE SURVEILLANCE AND TRACKING SYSTEM (SSTS) HAVE BEEN COMPLETED.

o FABRICATION OF AIRBORNE OPTICAL ADJUNCT (AOA) EXPERIMENTAL HARDWARE HAS BEEN INITIATED.

o CONCEPT DEFINITION FOR AIRBORNE OPTICAL SURVEILLANCE

EXPERIMENT AND THE LASER RANEGR HAVE BEEN INITIATED.

- PRELIMINARY DESIGN CONTRACTS FOR TERMINAL IMAGING RADAR (TIR) HAVE BEEN INITIATED.

MEASUREMENTS

- A ROCKETBORNE EARTHLIMB VIEWING AURORAL EXPERIMENT CALLED SPIRIT I WAS COMPLETED AND SENT TO ALASKA.

DIRECTED ENERGY WEAPONS (DEW) TECHNOLOGY PROGRAM

THE DIRECTED ENERGY PROGRAM IDENTIFIES AND VALIDATES THE TECHNOLOGY FOR DIRECTED ENERGY WEAPONS DESIGNED TO:

- DESTROY ENEMY BOOSTERS AND POST-BOOST VEHICLES IN THE TENS TO A FEW HUNDREDS OF SECONDS THAT THE MISSILES ARE IN THEIR BOOST PHASE; AND
- DISCRIMINATE DECOYS FROM WARHEADS BY PROBING THEM WITH A DIRECTED ENERGY BEAM THAT INTERACTS WITH THE TARGET AND SCATTERS RADIATION FROM THE NUCLEAR WARHEAD OR CREATES OTHER IDENTIFYING SIGNATURES.

THE DEW RESEARCH EFFORTS ARE CONSOLIDATED INTO FOUR PRINCIPAL PROJECTS UNDER THE PROGRAM MANAGED BY THE DIRECTED ENERGY OFFICE. THESE PROJECTS ARE TECHNOLOGY BASE DEVELOPMENT, TECHNOLOGY INTEGRATION EXPERIMENTS, CONCEPT FORMULATION AND TECHNICAL DEVELOPMENT PLANNING, AND SUPPORT PROGRAMS.

THE TECHNOLOGY BASE MUST ADVANCE THE TECHNOLOGIES THAT PERFORM, WITHIN THE DIRECTED ENERGY WEAPON, THE FUNCTIONS OF GENERATING THE BEAM; CONDITIONING THE BEAM AND DELIVERING IT TO BE PROPAGATED TOWARD THE TARGET; FOCUSING AND PROPAGATING THE BEAM AT THE TARGET ALONG A PRESCRIBED PATH; AND ACQUIRING THE TARGET TO BE ENGAGED, ESTABLISHING THE LINE-OF-SIGHT TO HIT THE

TARGET, HOLDING THE BEAM ON THE TARGET, ASSESSING THE RESULTING DAMAGE, AND THEN REINITIATING THE SEQUENCE TO ENGAGE RAPIDLY A NEW TARGET.

TECHNOLOGY INTEGRATION EXPERIMENTS ARE PROOF-OF-FEASIBILITY EFFORTS WHICH INTEGRATE AND VALIDATE TECHNOLOGY FOR SELECTED CONCEPTS. THESE PROJECT INCLUDE GROUND-BASED INDUCTION LINAC, FREE ELECTRON LASER; NEUTRAL PARTICLE BEAM INTERACTIVE DISCRIMINATION; AND SPACE POINTING AND TRACKING EXPERIMENTS. THESE MAJOR EXPERIMENTS LEVERAGE OPPORTUNITIES FOR REALIZING SIGNIFICANT EXPERIMENTAL GAINS IN SPECIFIC PROMISING CONCEPTS FOR BOOST-PHASE INTERCEPT AND MIDCOURSE DISCRIMINATION.

THE OTHER TWO PROJECTS UNDER THE DIRECTED ENERGY PROGRAM AND CONCEPT FORMULATION AND TECHNICAL DEVELOPMENT PLANNING, AND INNOVATIVE SCIENCE AND TECHNOLOGY AND SUPPORT PROGRAMS. CONCEPT FORMULATION AND TECHNICAL DEVELOPMENT PLANNING FUNDS ACTIVITIES THAT WILL GUIDE THE DIRECTED ENERGY WEAPONS TECHNOLOGY DEVELOPMENT EFFORTS BY REVIEWING AND EVALUATING TECHNICAL REQUIREMENTS AND BY PROVIDING CONCEPTUAL DESIGNS OF OPERATIONAL SYSTEMS RELATED TO ARCHITECTURAL STRUCTURES EMERGING FROM EFFORTS WITHIN THE SYSTEMS DEVELOPMENT PROGRAM ELEMENT. THESE PLANNING ACTIVITIES WILL HELP IDENTIFY AND RESOLVE CRITICAL DEW ISSUES ON A SCALE THAT ESTABLISHES THE TECHNICAL FEASIBILITY OF ACHIEVING WEAPON-LEVEL PERFORMANCE.

SURVIVABILITY, LETHALITY AND KEY TECHNOLOGIES (SLKT) PROGRAM

IMPORTANT FACTORS IN DECIDING WHETHER OR NOT TO DEVELOP AND DEPLOY A STRATEGIC DEFENSE MUST BE EFFECTIVENESS, AFFORDABILITY AND SURVIVABILITY. THE SLKT PROGRAM PERFORMS RESEARCH IN KEY TECHNOLOGIES THAT ARE CRITICAL TO THAT DECISION.

THE SLKT PROGRAM ELEMENT IS ORGANIZED INTO THE FOLLOWING

FIVE PROJECTS: SYSTEMS SURVIVABILITY; LETHALITY AND TARGET HARDENING; SPACE POWER AND POWER CONDITIONING; SPACE TRANSPORTATION AND SUPPORT; AND MATERIALS AND STRUCTURES DEVELOPMENT. A SIXTH PROJECT, COUNTERMEASURES, HAS BEEN ADDED TO THE SLKT PROGRAM ELEMENT IN FY 1987 TO SUPPORT THE WORK PLANNED BY THE SDIO COUNTERMEASURES OFFICE.

THE SYSTEM SURVIVABILITY PROJECT INVESTIGATES CONCEPTS AND TECHNOLOGIES DESIGNED TO ASSURE DEFENSIVE SYSTEM FUNCTIONAL SURVIVABILITY. THE PROJECT IS CONCERNED WITH THE SYSTEM SURVIVABILITY FOR OPERATIONAL DEPLOYMENTS OF BOTH INITIAL STRATEGIC DEFENSES AND FOR FOLLOW-ON DEFENSIVE SYSTEMS THAT ARE EFFECTIVE AGAINST A FULLY RESPONSIVE DEFENSE SUPPRESSION THREAT.

THE LETHALITY AND TARGET HARDNESS PROJECT ADDRESSES THE IMPORTANT ISSUE OF THE PRECISE EFFECTIVENESS OF ANY STRATEGIC DEFENSE. IT IS A PROJECT DESIGNED TO PERFORM COMPREHENSIVE RESEARCH, ADDRESSING SUCH AREAS AS EFFECTS DAMAGE AND VULNERABILITY OF ENEMY TARGETS CAUSED BY CONCEPTUAL KINETIC AND DIRECTED ENERGY WEAPONS. THE CURRENT TASKS INCLUDE THE STUDY OF THE EFFECTS OF THERMAL/IMPULSE/X-RAY LASER, PARTICLE BEAMS, KINETIC ENERGY PROJECTILES, AND HIGH POWER MICROWAVES ON TARGETS OF INTEREST. THE EFFORT INCLUDES A MATERIALS ASSESSMENT PROGRAM TO ASCERTAIN THEORETICAL HARDENING LIMITS.

THE SPACE POWER AND CONDITIONING PROJECT COORDINATES EFFORTS TO DEVELOP VIABLE POWER GENERATION AND CONDITIONING TECHNIQUES CAPABLE OF PROVIDING THE LARGE QUANTITIES OF SPECIALLY CONDITIONED ELECTRICAL POWER FOR SPACE-BASED WEAPONS, SURVEILLANCE, COMMUNICATION, AND BATTLE MANAGEMENT SYSTEMS.

THE ECONOMIC FEASIBILITY OF A MULTITIERED BALLISTIC MISSILE DEFENSE SYSTEM AGAINST A FULLY RESPONSIVE THREAT MAY WELL DEPEND ON THE CAPABILITY TO DEPLOY, SUPPLY AND MAINTAIN SUCH A SYSTEM.

THE SPACE TRANSPORTATION AND SUPPORT PROJECT FUNDS THE INVESTIGATION OF SPACE LOGISTICS INFRASTRUCTURES, AS WELL AS TECHNOLOGIES AND TECHNIQUES TO SUPPORT AN EXTENSIVE SPACE FORCE OF THE MAGNITUDE AND COMPLEXITY ENVISIONED. AREAS TO BE INVESTIGATED INCLUDE, BUT ARE NOT LIMITED TO, HEAVY LIFT LAUNCH VEHICLES, ORBIT-TO-ORBIT TRANSFER SYSTEMS, ON ORBIT ASSEMBLY/SERVICING, ROBOTICS, REUSABLE SYSTEMS, ADVANCED TECHNOLOGY PROPULSION ENGINE SYSTEMS, AVIONICS, AND CONTROL SYSTEMS.

RESEARCH IS BEING CONDUCTED BY DOD, DOE, AND NASA ON MATERIALS AND LARGE STRUCTURES TO BE USED IN SPACE AND ON MATERIALS DESIGNED TO INCREASE THE SURVIVABILITY OF U.S. ELEMENTS AGAINST NATURAL AND HOSTILE ENVIRONMENTS. THERE IS ALSO RESEARCH INTO STRUCTURES REQUIREMENTS FOR VARIOUS SPACE SYSTEMS CONCEPTS APPLICABLE TO A STRATEGIC DEFENSE.

IT HAS BEEN WIDELY RECOGNIZED THAT IN ORDER FOR SDI SYSTEM CONCEPTS TO BE CREDIBLE TO OPPONENTS AND PROPONENTS ALIKE, THE CONCEPTS HAVE TO BE CAREFULLY AND THOROUGHLY EXAMINED BY AN INDEPENDENT RED TEAM. THE COUNTERMEASURES PROJECT SUPPORTS A SERIES OF RED TEAMS TO IDENTIFY POSSIBLE SOVIET RESPONSES TO SDI ELEMENTS AND TO ENSURE THAT THE IMPLICATIONS OF THESE RESPONSES ARE CONSIDERED IN THE DEVELOPMENT PHASE.

SIGNIFICANT ACCOMPLISHMENTS (FY 1984-1985)

INITIAL RESEARCH IN SURVIVABILITY TECHNOLOGIES HAS ALREADY PRODUCED PROMISING CONCEPTS AND DESIGNS FOR SEVERAL AREAS. A MULTIYEAR TECHNOLOGY DEVELOPMENT AND TEST PROGRAM WAS DEVELOPED TO SUPPORT SYSTEM DEFINITION EFFORTS. TECHNICAL REQUIRMENTS AND CONCEPT STUDIES INITIATED IN FY 1984 WERE COMPLETED AND HAVE ESTABLISHED THE ROLE SOME TECHNOLOGIES WILL PLAY IN STRATEGIC DEFENSE SYSTEMS. THE REQUIRED TECHNOLOGY BASE TO ESTABLISH THE

VIABILITY OF SOME CIRCUITS TO PROVIDE EXTREMELY HARD ELECTRONICS HAS MADE EXCELLENT PROGRESS. SEVERAL DEVICES TO PROTECT ELECTRONICS FROM SYSTEM GENERATED EMP (SGEMP) SURGE CURRENTS HAVE BEEN DEVELOPED AND TESTED WITH DESIGN METHODOLOGY CONFIRMED.

THE LETHALITY AND TARGET HARDENING PROJECT HAS ACHIEVED THE MOST PROGRESS AMONG THE SLKT PROJECTS. FOR A NUMBER OF YEARS, VARIOUS SERVICES AND AGENCY PROGRAMS HAD SUPPORTED LIMITED EXAMINATIONS OF PARTICULAR APPLICATIONS. PORTIONS OF THESE PROGRAMS WERE INTEGRATED INTO THE SDI LETHALITY PROJECT. IN FY 1984-1985 CONTINUOUS WAVE LASER TESTS WERE CONDUCTED AT *HELSTF* ON FULL-SCALE SOLID AND LIQUID BOOSTERS UNDER SIMULATED FLIGHT LOADS. IMPACT TESTS WITH KINETIC ENERGY PROJECTILES AT VELOCITIES UP TO 8 KM/SEC WERE PERFORMED. AND CONSTRUCTION WAS INITIATED ON A DEDICATED PARTICLE BEAM LETHALITY TEST BED AT BROOKHAVEN NATIONAL LABORATORY TO BE FINISHED IN FY 1986.

KINETIC ENERGY WEAPONS (KEW) PROGRAM

ACTIVITIES IN THIS PROGRAM SUPPORT WEAPONS OPTIONS FOR ALL PHASES OF A MUTITIERED DEFENSE. AS A RELATIVELY MATURE SET OF TECHNOLOGIES, THESE EFFORTS ARE NOT ONLY A MAJOR CANDIDATE FOR PROVIDING THE INTERCEPT AND KILL FUNCTIONS OF ANY INITIAL BALLISTIC MISSILE DEFENSE DEPLOYMENT BUT PROVIDE THE MAJOR CONTRIBUTION TO A HEDGE AGAINST A SOVIET BREAKOUT OF THE ABM TREATY.

KINETIC ENERGY GUIDED PROJECTILES CAN BE ACCELERATED BY CHEMICALLY PROPELLED BOOSTERS OR, IN THE LONGER TERM, BY HYPERVELOCITY ELECTROMAGNETIC MEANS. IN EITHER CASE, PROJECTILES RELY ON NONNUCLEAR KILL MECHANISMS. THE KINETIC ENERGY PROGRAM IS DEVELOPING TECHNOLOGY FOR: SPACE-BASED, ROCKET-ACCELERATED

KINETIC KILL VEHICLES (KKVs) FOR ICBM INTERCEPT AND SATELLITE DEFENSE; GROUND-LAUNCHED, HIGH-VELOCITY, HIGH ENDOATMOSPHERIC INTERCEPTORS; GROUND-LAUNCHED, EXOATMOSPHERIC INTERCEPTORS; ADVANCED HYPERVELOCITY RAIL GUNS; AND SUPPORT ITEMS, SUCH AS FIRE CONTROL COMPONENTS THAT COVER ALL ASPECTS OF KINETIC ENERGY WEAPONS.

IT SHOULD BE NOTED THAT KINETIC ENERGY WEAPONS ARE VERY USEFUL IN THE DEFENSE OF SPACE PLATFORMS. PERFORMANCE OBJECTIVES ARE A FUNCTION OF THE ALTITUDE AND HARDNESS OF THE SPACE-PLATFORM ORBIT, THREAT YIELDS AND ARRIVAL RATES, AND THREAT NUMBERS PER PLATFORM.

IN ORDER TO ACCOMPLISH THE STATED TECHNICAL OBJECTIVES AND TO PROVIDE THE CONFIDENCE NECESSARY FOR AN EARLY 1990s DECISION, THE KEW PROGRAM IS STRUCTURED IN SIX MAJOR THRUSTS -- SPACE SYSTEMS FOR BOOST PHASE INTERCEPT; EXOATMOSPHERIC NONNUCLEAR KILL INTERECPTORS; ENDOATMOSPHERIC NONNUCLEAR KILL INTERCEPTORS; CAPABILITIES AGAINST SHORTER RANGE THREATS; ELECTROMAGNETIC ACCELERATORS; AND TESTING AND FACILITIES SUPPORT.

IN TECHNOLOGY BASE ACTIVITIES, TECHNOLOGIES RELATING TO PRECISION KKV PROJECTILES ACCELERATED BY ROCKETS OR HYPERVELOCITY GUNS WILL BE EXPLORED TO PROVIDE POTENTIAL NONNUCLEAR KILL OF BALLISTIC MISSILES IN ALL PHASES OF FLIGHT -- BOOST, MIDCOURSE, AND TERMINAL.

SIGNIFICANT ACCOMPLISHMENTS (FY 1985-1985)

OVER THE LAST 2 YEARS THE KINETIC ENERGY WEAPON PROGRAM HAS PRODUCED SEVERAL ACCOMPLISHMENTS. THE MOST SIGNIFICANT OF THESE IS THE DEMONSTRATION OF AN ACTUAL REENTRY VEHICLE MIDCOURSE INTERCEPT IN THE HOMING OVERLAY EXPERIMENT (HOE) CONDUCTED BY THE ARMY.

OTHER MAJOR KINETIC ENERGY TECHNOLOGY ACCOMPLISHMENTS INCLUDE TESTING OF ELEMENTS SUCH AS DIVERT PROPULSION THRUSTERS AND PROPELLANTS NECESSARY FOR LIGHT-WEIGHT INTERCEPTOR FABRICATION. IN ADDITION, DETAILED ANALYSIS HAS BEEN COMPLETED TO DEFINE THE PERFORMANCE ERQUIREMENTS NECESSARY FOR THE VARIOUS INTERCEPTION SCENARIOS.

IN THE HYPERVELOCITY LAUNCHER AREA, A NUMBER OF LABORATORY DEVICES HAVE BEEN UTILIZED TO TEST THE FEASIBILITY OF MULTIPLE SHOT WITH A SINGLE GUN BARREL AND THE FEASIBILITY OF HIGH-g SURVIVABLE PROJECTILE COMPONENTS.

SYTEMS ANALYSIS AND BATTLE MANAGEMENT (SA/BM)

THE ACTIVITIES INCLUDED IN THE SYSTEMS ANALYSIS AND BATTLE MANAGEMENT PROGRAM OF THE SDIO PROVIDE TWO KEY CRITERIA THAT DRIVE THE OTHER SDIO PROGRAMS. THE SYSTEMS ANALYSIS EFFORTS DEFINE THE PERFORMANCE REGIMES OF THE INDIVIDUAL SYSTEMS THAT MAKE UP THE DEFENSE ARCHITECTURE THAT MUST BE MET IF DEFENSES AGAINST RESPONSIVE THREATS ARE TO BE REALIZED. THE BATTLE MANAGEMENT EFFORTS DEFINE THE OPERATIONAL ENVIRONMENT FOR DECISIONS, RULES, CONSTRAINTS, AND DIRECTIONS IN WHICH INDIVIDUAL SYSTEMS MUST PERFORM.

SYSTEMS ANALYSIS PROVIDES THE SYSTEMATIC APPROACH THAT ASSISTS THE MANAGERS OF THE SDI IN CHOOSING COURSES OF ACTION. THROUGH A SERIES OF STUDIES, ANALYSES AND EVALUATIONS, WE HAVE BEEN PROVIDED A FULL RANGE OF ISSUES AND PROBLEMS. WE HAVE BEEN ABLE TO IDENTIFY RELEVANT OBJECTIVES AND ALTERNATIVES, AND EXAMINE VARIOUS ANALYTICAL COMPARISIONS OF THOSE OBJECTIVES AND ALTERNATIVES IN LIGHT OF THEIR CONSEQUENCES.

THE SPECIFIC TASKS WITH THE SYSTEMS ANALYSIS PROJECT INCLUDE THE ARCHITECTURE TASK, THE THREAT ANALYSIS TASK, THE TECHNOLOGY

INTEGRATION TASK AND THE ARCHITECTURE ANALYSIS SUPPORT TASK. THE ARCHITECTURE TASK IS STRUCTURED TO DEFINE AND EVALUATE CANDIDATE SYSTEM ARCHITECTURES, SYSTEM CONCEPTS AND PARAMETRIC TRADE-OFFS LEADING TO THE EVALUATION OF PREFERRED ARCHITECTURES AND ALLOWING ASSESSMENT OF KEY TECHNOLOGIES AND SYSTEM FUNCTIONS.

THE THREAT ANALYSIS EFFORT WILL PROVIDE PROJECTIONS OF POSSIBLE THREAT STRUCTURES USABLE AGAINST THE U.S. AND ITS ALLIES. ANALYSIS WILL ALSO BE PERFORMED TO DEFINE RESPONSES WHICH MIGHT BE INVOKED TO COUNTER DEFENSE CONCEPTS.

THERE ARE THREE BROAD CATEGORIES UNDER TECHNOLOGY INTEGRATION: AFFORDABILITY, LOGISTICS INTEGRATION AND TECHNICAL INTEGRATION. WITHIN THESE CATEGORIES THERE ARE SEVERAL TASKS FOR ACCOMPLISHMENT BY THE SDIO AND THE SERVICES.

SIGNIFICANT ACCOMPLISHMENTS (FY 1984-1985)

IN COORDINATION WITH THE INTELLIGENCE COMMUNITY AND OTHER SDI PROGRAMS, A TIME-PHASED EXPECTED STRATEGIC THREAT AND ATTACK SCENARIO WAS DEFINED. WITHIN THIS SCENARIO STRATEGY AND POLICY ISSUES AND CONSTRAINTS WERE REGARDED AND FULLY EXAMINED. DURING FY 1984-1985 THERE WAS A CONTINUATION OF ANALYSES AND EVALUATION OF BOOST, POST-BOOST, MIDCOURSE AND TERMINAL PHASE SDI CONCEPTS INTIATED IN THE PREVIOUS YEAR AND ARCHITECTURE METHODOLOGY AND SELECTION CRITERIA WERE DEVELOPED.

ARCHITECTURAL SYSTEMS AND COST MODELS WITH INTERACTIVE APPLICATION AND REFINEMENT TO THE ARCHITECTURES WERE CHOSEN ON A MORE GENERIC LEVEL. EXAMINATION OF THE IMPACT OF FUTURE TECHNOLOGIES AND NATIONAL RESOURCES ON STRATEGIC DEFENSES, STRATEGY AND POLICY WAS BEGUN.

BATTLE MANAGEMENT/COMMAND, CONTROL AND COMMUNICATIONS (BM/C 3)

THE PRIMARY OBJECTIVE OF THIS PROJECT IS TO SPECIFY, DESIGN, DEVELOP AND VERIFY THE TECHNOLOGIES REQUIRED FOR BATTLE MANAGEMENT CAPABILITIES; COMMAND, CONTROL AND COMMUNICATIONS NETWORKS; AND THEIR INTERFACES. THE GOAL IS TO PROVIDE EFFECTIVE CAPABILITIES TO EXAMINE COMMAND CONTROL OVER A MULTITIERED DEFENSE. SPECIFIC EMPHASIS IS ON ACHIEVING THE REQUIRED BATTLE MANAGEMENT ALGORITHMS; RELIABLE, FAULT-TOLERANT, HIGH PERFORMANCE PROCESSING; COMMUNICATIONS AND SOFTWARE.

THE BATTLE MANAGEMENT SOFTWARE TO BE DEVELOPED FOR THE SDI MAY BE THE MOST COMPLEX EVER ATTEMPTED. TO BE REASONABLY CERTAIN IT WILL BE DEVELOPED ON TIME, WITHIN SCHEDULE AND WILL CORRECTLY AND SAFELY IMPLEMENT THE FUNCTIONALITY OF THE SYSTEM, THE LABOR INTENSIVE ASPECTS OF THE SOFTWARE DEVELOPMENT, TEST AND MAINTENANCE PROCESSES MUST BE MADE MORE EFFICIENT AND TRUSTED. BY AUTOMATING SIGNIFICANT PARTS OF THESE PROCESSES, CONSISTENCY, COMPLETENESS AND CORRECTNESS CAN BE BETTER ASSURED AND DEPENDENCY ON SPECIFIC INDIVIDUALS LESSENED.

SOFTWARE FOR A MULTILAYERED BALLISTIC MISSILE DEFENSE WILL BE VERY COMPLEX, NOT ONLY DUE TO THE AMOUNT OF SOFTWARE REQUIRED, BUT ALSO DUE TO THE FUNCTIONS TO BE CARRIED OUT BY SOFTWARE. THE COMPLEXITY WILL DIRECTLY RELATE TO REQUIREMENTS FOR LARGE SOFTWARE SYSTEMS THAT CAN BE EXPLICITLY TRUSTED TO CARRY OUT MISSION REQUIREMENTS, WHICH CAN BE RELIABLY MODIFIED AND ADAPTED TO CHANGING DEFENSE NEEDS AND WHICH CAN BE GUARANTEED TO HAVE DESIRABLE BEHAVIOR UNDER ALL CONCEIVABLE STRESSING CONDITIONS.

THE BASIC OBJECTIVE OF SOFTWARE RESEARCH IS TO PROVIDE THE TECHNIQUES, TOOLS, FACILITIES AND METHODOLOGY REQUIRED TO SUPPORT THE BATTLE MANAGEMENT SOFTWARE DEVELOPMENT. A MAJOR MILESTONE OF THIS PROGRAM WILL BE A SOFTWARE ENGINEERING SYTEM ENCOMPASSING

ALL HIGH-PAYOFF TOOLS AND METHODS IN FY 1989.

SIGNIFICANT ACCOMPLISHMENTS (FY 1984-1985)

A CONSORTIUM OF UNIVERSITIES HAS BEEN ESTABLISHED TO EVALUATE THE ROLE OF KNOWLEDGE-BASED AND ARTIFICIAL INTELLIGENCE FOR BM/C 3. A DISTRIBUTED ALGORITHM TEST BED HAS BEEN ESTABLISHED FOR BM/C 3 ALGORITHMS TESTING AND EVALUATION. NETWORK PROTOCOL REQUIREMENTS HAVE BEEN DEFINED AND TECHNIQUES FOR NETWORK CONTROL ARE BEING ASSESSED FOR BM/C 3 ARCHITECTURE ALTERNATIVES. ARCHITECTURE REQUIREMENTS HAVE BEEN SPECIFIED FOR FAULT TOLERANT, DISTRIBUTED PROCESSORS AND DEVLOPED SPECIFICATIONS FOR SPACE-QUALIFIED, RADIATION HARDENED COMPONENTS. SPECIFICATIONS HAVE BEEN DEVELOPED FOR MILLIMETER-WAVE ELEMENTS FOR SPACE-TO-GROUND C 2 LINKS. COMMUNICATION LINK REQUIREMENTS CHARACTERIZATION AND DEFINITION HAS BEEN PRODUCED. AN INITIAL SET OF AUTOMATED SOFTWARE DEEVLOPMENT TOOLS THAT ARE BEING ASSESSED FOR THEIR EFFICACY IN AN INTEGRATED, AUTOMATED SOFTWARE DEVELOPMENT ENVIRONMENT ALSO WERE DEVELOPED.

CONCLUDING OBSERVATIONS

IN SUMMARY I WOULD LIKE TO IMPRESS UPON THE COMMITTEE MEMBERS THAT MY STATEMENT IN NO WAY COVERS *ALL* OF THE SIGNIFICANT TECHNICAL AND EXPERIMENTAL ACCOMPLISHMENTS ACHIEVED OVER THE PAST FEW YEARS. AS ALWAYS I WOULD WELCOME THE OPPORTUNITY TO BRIEF YOU OR YOUR STAFFS TO ADDRESS ANY QUESTIONS YOU MIGHT HAVE IN ANY PHASE OF THE SDI PROGRAM. AGAIN, THANK YOU FOR THE OPPORTUNITY TO APPEAR BEFORE YOUR COMMITTEE AND I WELCOME YOUR QUESTIONS.

FUND TRANSFERS

General ABRAHAMSON. The chairman did want me to address two very specific questions. They had to do with the subject of the funds transfer from the Department of Defense to the Department of Energy for several of the nuclear activities that are included in the program and he did ask that I address the question that has been raised in the public press about disinformation.

I would like to very briefly discuss those two issues. Then I would like to make one additional statement and, at that point, I will be available for any of your questions.

The funds transfer is one that we debated for some time. It is based on some of the progress that has been made in some of the nuclear concepts and I would once again go back to the fundamental question. We dealt with this in some open testimony, but for a very brief review, there is a very legitimate reason to include nuclear testing as part of our examination in the SDI Program. It is even broader than the SDI Program, by the way.

It is because there is essentially a third generation of nuclear weapons that is on the horizon and coming very, very quickly. They are coming both on our side and on the Soviet side. We have very little understanding of the progress that they have made on their side, but we have some very great concerns.

X-RAY LASER

Now, the most publicized of these is the x-ray laser. It could be used by either our side or their side in a ground popup version that has been talked about a great deal. That means it could come from submarines if one wanted to use it in a boost phase. It could come from the Soviet side. It could come as a countermeasure to be used against various space assets of our SDI system. That is one of the main reasons we are so very concerned with the technical progress that could be made.

In the chart I am now showing, the parts that are painted red might be U.S. MX's or submarine-launched missiles and somewhere in the midcourse on the way to the Soviet Union they could use the concept of directed energy, the third-generation weapons.

[Deleted.]

[Deleted.] These laser beam bundles when hit by that radiation causes actual lasing. It occurs in x-ray region and that is why it is called x-ray laser, itself.

The way to think about that is that instead of using the bomb itself for explosion, whose purpose is to destroy people or targets on the Earth, it occurs in space where it is essentially harmless.

Here it goes off in all directions, but these direct, very, very carefully, the energy to the target that you want. Now, the problem and the thing that we have been concerned with is that this first appeared in the Soviet literature in 1974. It occurred there before it did in the United States.

The reason that we include it is not only for SDI purposes, but we do have this program going on looking at what are third-generation weapons and there are other concepts as well, is to understand——

[Senator Stevens arrives.]

Senator STEVENS. Go ahead. My apologies.

THIRD-GENERATION WEAPONS

General ABRAHAMSON. Sir, we were just starting and I had set aside the testimony and I am beginning to address two questions that you asked me to address.

One was the funds transfer and the second was disinformation, and indicating that there are these kinds of third-generation weapons.

The reason that we are conducting these tests is to understand just how lethal that might be and what that might mean as a countermeasure to SDI, how lethal it might be if the Soviets employed it against our present offensive weapons in the Soviet version of the SDI.

Obviously, when you do that, you cannot help but at least examine and see if there is going to be sometime in the future very reasonable applications and cost applications of this.

That does not mean that we are not following the President's direction. He knows we are conducting these experiments. He understands that. He also understands the reasons for it, but his direction is still clear: See if you can find an effective nonnuclear way of creating an effective laser defense against ballistic missiles.

But we had better know what they can do and that is the reason that we are conducting those tests.

NUCLEAR PARTS OF TEST

The nuclear parts of the test are funded under the Atomic Energy Act to the Department of Energy directly. There is a growing program in the Department of Energy to conduct a series of these kinds of tests.

The reason that we have this anomaly in fiscal year 1986 and why we asked for a funds transfer is that we had several successes. In this kind of business, and particularly in something as esoteric as this, there is never any absolutely clear success.

But we did demonstrate that you can lose using these techniques. [Deleted.]

There were [deleted] tests that were conducted after the fiscal 1986 budget was proposed to the Congress that said that we had better ramp up and understand this and understand it as early as possible. Previously we probably would only have had [deleted].

We thought we ought to try to increase that on the order of [deleted]. In order to make a reasonable transition to a higher funding level which is being proposed in fiscal year 1987, we wanted some bridge money. We thought it was more than enough, even with the budget cuts that we have taken, that we would fence for some of those moneys.

Now, the proper way to do that and the legal way to do that, recognizing the difference in the appropriations responsibilities by the committees that have oversight over the DOE budget and the Department of Defense, is a formal funds transfer.

So, it took a little time and we argued about the legality of that for some time among ourselves, but we did propose it and that is why it is here for your consideration.

Are there any questions on this?

Senator STEVENS. Does anybody have any questions on this?

LOCATION OF TESTS

Senator MCCLURE. Where did these tests take place?

General ABRAHAMSON. At the Nevada proving site. Do not assume that, for example, all of those nuclear tests are SDI tests. In fact, only a small percentage are.

LABORATORIES INVOLVED IN TESTING

Senator MCCLURE. What laboratories are working on these tests?

General ABRAHAMSON. Livermore Lab is leading the x-ray laser experiments, but there is support activity going on from both Sandia and Los Alamos. For some of the other laser, nuclear-driven concepts, Los Alamos is in the lead.

Those three locations—Los Alamos, Livermore, and Nevada test site—are involved. The status of that, as I understand it, is that the request was made by the President. The House Appropriations Committee has approved it and included it in their omnibus supplemental bill which has yet to be voted on.

After that is voted, and assuming that it passes, then it will come to the Senate for consideration.

Senator STEVENS. Senator Proxmire.

X-RAY LASER

Senator PROXMIRE. General, from what you have just told us and from what your scientists have said in briefings, the x-ray laser has been [deleted].

The only near-term deployment option would be as a [deleted] is that correct?

General ABRAHAMSON. I do not think that is the right perspective at all, sir, honestly.

Let me go back to the President's direction. It was never selected as a concept, a primary concept in the architecture. It is selected as a concept that we determined needed to be better understood. If it were ever used, whether it would be used in the [deleted] kind of situation or in the [deleted] would depend a great deal on the amount of success that is evidenced in these tests.

BRIGHTNESS LEVELS

Now, the reason we are so concerned about it is that the theoretical calculations and some of the model calculations show that you can get to very high brightness levels.

Senator PROXMIRE. Brightness what?

General ABRAHAMSON. Brightness levels. Think of it as a visible laser with a great deal of destructive power.

Senator PROXMIRE. My question is in the near term at least. I notice you mentioned in your presentation it was [deleted] rather than [deleted].

General ABRAHAMSON. It could not be used right away in the [deleted].

Senator JOHNSTON. In order to use it in the [deleted] phase, as I understand it, you would have to [deleted]. That is what our staff has been told by scientists.

General ABRAHAMSON. You would have to get it up very quickly, depending on exactly where it is you wanted to employ it, what your bases were in the distancing, the operational side. I do not know that [deleted] is the root number.

Senator PROXMIRE. But the right magnitude?

General ABRAHAMSON. The principle you are after is correct. We would speed it up. We would want to get it up quickly.

IMPULSE SPECIFICATIONS

Senator PROXMIRE. As I understand it, improvements in specific impulse do not come in leaps and bounds and we are not looking at any leaps and bounds increase in specific impulse?

General ABRAHAMSON. We are for space-based applications, not for surface applications.

Senator PROXMIRE. All space based?

General ABRAHAMSON. Yes. By the way, we had essentially a fast-burn kind of concept way back in 1972, part of that ABM system. The Sprint missile was a fast-burn concept of the kind that could put one of those systems up.

Senator PROXMIRE. But not in time to be used in the atmosphere?

General ABRAHAMSON. No. In fact, the x-ray laser cannot penetrate deeply into the atmosphere. We do not know how far it can go. There is a process that the scientists call bleaching. That means it can go part way in the atmosphere, but we do not know how effective that would be. [Deleted.]

Senator PROXMIRE. Thank you.

DISINFORMATION

General ABRAHAMSON. The second question was this disinformation business. We have made a statement and go on record that we have never presented—and I certainly personally have never knowingly presented—false information either to the Congress or to the press and I do not think that is the way to conduct this program and I do not think that we would, in the future in any way, conduct that kind of effort.

That does not mean that there may not be a time when you would like, through other channels, to give the Soviets a different feeling for where you are. But we have never presented false information either to the press or to the Congress. I am absolutely opposed to that principle.

Senator STEVENS. I have difficulty trying to put together the two assertions made about the program, General.

One is that there has been this disinformation program and the other——

General ABRAHAMSON. There has not.

GENEVA BRIEFING TO SOVIETS

Senator STEVENS [continuing]. And the other is criticism of the briefing you gave to the Soviet negotiators at Geneva at the request of Ambassador Kampleman.

Was the briefing that was given in Geneva disinformation?

General ABRAHAMSON. No, sir.

Senator STEVENS. Was it classified information?

General ABRAHAMSON. No, sir; it was very carefully constructed. If we had given that briefing, you would have recognized the entire briefing. I have given essentially that kind of information in unclassified forms here in the United States many times, both publicly and in Congress as well.

So, it was an unclassified briefing that was very carefully assembled, but was represented as an official statement to the Soviet delegation about the objectives of the program and the fundamental direction, how we were proceeding, and, in essence, they have had people here so they know most of that information. It was not new information.

Senator STEVENS. I wonder if there has been some problem about this, because part of us are involved in the observer group for the arms control talks and we have a general agreement that anything that goes on in connection with the arms control activities in Geneva is classified. That was our understanding. And to avoid any concept of disclosure of anything that went on there, that we have agreed that anything that goes on is classified.

As a matter of fact, we even treat as classified the fact that you had briefed the Soviets.

General ABRAHAMSON. I did until there was a judgment and Secretary Shultz decided that it was important to let our own people know what we had done on it.

Senator STEVENS. It was not classified per se. It was just part of the overall structure of the Geneva negotiations; therefore, everyone was asked to treat it as though it were classified.

Is that the problem we run into in regard to your briefing to the Soviets?

General ABRAHAMSON. Yes, sir; the contents were unclassified, but because of the procedural question that you outlined, in order to allow the negotiations to proceed with candor and to try to minimize this public propaganda adjunct that goes on as part of those, there was the ground rule that you mentioned, that everything that is discussed is classified.

Therefore, even though the content of my briefing was unclassified, once it was given in a postplenary session, then it and the questions that were asked by the Soviets of me became classified. By the way, the briefing itself was read by one of my people.

What I did was to answer questions just as directly and honestly as I could.

Senator STEVENS. I was part of the original negotiations, General, when these things started. All of us involved, Senator Nunn was, we all agreed that it was a request originally of the Soviets and our American negotiators, the negotiators themselves asked that everything concerning the negotiations be treated as being classified on a secret level. We have respected that.

We do not talk about what they tell us. We can come away with our own impressions, but we do not talk about it. We did not talk about it in the briefing you gave because of that.

CLASSIFIED INFORMATION GIVEN TO SOVIETS

Senator PROXMIRE. May I follow up on that a little bit because the Defense Week issue of March 24 says:

> Colonel Worden confirmed and General Espey reiterated that some classified information, although not a full-scale briefing, has been given to the Soviets.

Worden only described classified details, and I quote:

> Certain kinds of information that we have data.

He said the information would remain classified even after it had been given to the Soviets in order to avoid public discussion or disclose sources and methods.

Is he wrong?

General ABRAHAMSON. Lt. Col. Worden is part of our observer team that is over there. That comment had to do with the broader element of negotiations and, frankly, he should not have said that. He was trying to be candid in his answer to the press.

Senator PROXMIRE. Is he right or wrong when he says certain kinds of information in the way of data has been given to the Soviets, the information would remain classified even after it had been given the Soviets; is that correct?

General ABRAHAMSON. When one is in a negotiation and you are talking about things and you are saying, "We know you have an SDI Program, we know that you have a laser at Sharishegan," and then they say we do not have a laser at Sharishegan, then you say, or a way of explaining that is to refer to your own classified intelligence materials, and some of that kind of thing has gone on where they know that [deleted] and vice versa.

Frankly, he went beyond what he should have when he made that statement. But in terms of the SDI, we have never given them any classified information. The unclassified data and the unclassified things that I presented, or were presented, and the answers that I gave in questions were subsequently classified as a matter of procedure, as the chairman stated.

Senator PROXMIRE. Thank you.

Senator JOHNSTON. To the same effect in the Washington Times of March 31:

> What the Colonel said Monday may have caused possible confusion because he also had said there were some circumstances in which the Soviets would be given valid classified information except from the American people.

I understand now that you are saying that that is correct, but the kind of information is information about what they have denied, our classified information which they have denied.

General ABRAHAMSON. Yes, sir. In order to give you a very specific answer to that question, perhaps I ought to take that for the record because I have not followed all of the negotiations on a day-for-day basis and some of that kind of information, but that is my best understanding of the course of some of the discussions that have gone on.

But those were not associated with SDI, our SDI; they were associated with what the Soviets were doing.

STRATEGIC PORTION OF NEGOTIATIONS

Senator STEVENS. In terms of the negotiations, there was a strategic portion of the negotiations on day-by-day basis. They are discussing with the Soviets things that are classified in this country. It is information as to the status of the Soviet systems.

I have been involved in those even in just personal conversations with the Soviet ambassadors. They raised certain specifics about Alaska; I raised certain specifics about locations of missiles that are east of the Urals, or something like that. All of that is derived from general knowledge of classified data.

I do not think we have ever said here is a classified document. I think that the trouble is that the press is still miffed over the fact that everything that goes on in connection with that is classified.

We have agreed not to talk about what goes on in the negotiations without regard to the level of classification because we have all agreed this is on a secret level. There is the source of this dissatisfaction.

Senator JOHNSTON. I can certainly understand that. Just to repeat, there has been no classified SDI information given to the Soviets, period?

General ABRAHAMSON. Correct.

Senator STEVENS. By you?

General ABRAHAMSON. By me.

Senator STEVENS. The negotiators in the strategic negotiation may well have done that, the ambassadors?

General ABRAHAMSON. I believe I know, at least about our SDI Program, what has been given and, to the best of my knowledge at least the classified portions of our SDI Program have not been given.

Senator STEVENS. I am not saying we have told the Soviets anything concerning our classified systems. I am saying we have classified information as to the status of their systems that we have disclosed in the course of those negotiations.

Do you have any questions about this? Could I go to something else?

OUTLAYS UNDER PROGRAM

General, last year we published this little report at the request of Senator Hollings, a similar request for a report this year concerning the rate of outlays under your program.

The staff tells me that the SDI obligation rate exceeds the rate of other military services for R&D for the same period of time. The outlay rate has remained slower with 40 percent of the fiscal year 1985 appropriations obligated to through September 20.

Do you have the final expenditure rate for fiscal year 1985?

General ABRAHAMSON. Sir, this is a troubling area for me from a management viewpoint. Let me try to put it in some context.

The money, obviously, that is appropriated under R&D recognizes that expenditures do trail obligations. We did, and I believe this represents the priority that the services have given to the program, we did obligate 96 percent of our entire program even though we were off to a kind of late and running start last year.

So, we obligated the entire, or very close to the entire, program, I think in an enviable record, and, yes, that exceeded what some of the services did in each of their R&D activities.

Now, the difference between obligations and expenditures, however, is another matter. The expenditure rate, there are certain things that are withheld, such as profits often withheld to a performance point on a program. Often contracts are withheld for a period of time so at the contractor level expenditures always trail substantially what are the obligations.

In addition to that, there have been some problems in terms of the accounting records in the Department of Defense for this new agency that we have really had to go back and squirrel out and find and that has required an awful lot of very hard work and, therefore, those expenditure rates that are referred to, that came out at the 40 percent at the end of the fiscal year, represented the accounting as it was accumulated at the DOD level.

Frankly, the expectation can and should be that all of it should be accounted for. But there are a large number of bills that were still circulating out through the Air Force, out through the Army, through the various accounting systems, Defense Logistics Agency system, that had not risen to that point.

We had the same kind of problem this year in terms of ensuring that we are straightening out all that accounting system. I have made that a matter of priority. I think we are making a great deal of progress in getting that straight.

What I am really trying to do is institute a cash flow management concept that is not normal for the Department of Defense procurement, particularly since the majority of the Department of Defense procurement has been built around multiyear funding for procurement programs.

So, you will see that there are still lags in expenditure rate.

On the other hand, I have instituted special reporting from the contractors so that I know at what levels, or at least the best estimate, of what we consider to be noncancelable commitments. That is the legal obligation they have to pay during the year.

MINIMUM FUNDING REQUIREMENTS

Senator STEVENS. When will we be able to determine what will be the minimum amount of funding that will be required to sustain all existing contracts that have been entered into in 1986, or prior thereto, in terms of the 1987 dollars required? When will we be able to get that figure?

I am fearful for this program this year, as you know.

General ABRAHAMSON. Yes, I know.

Senator STEVENS. I have reviewed briefly, I have not read the whole thing, a summary of the staff report prepared for us and Senators Proxmire, Johnston, and Chiles. I assume you have it?

General ABRAHAMSON. Yes, sir.

PRIORITY SHIFTS IN SDIO

Senator STEVENS. It is critical of priority shifts in SDIO.

I would like to know what the date is when we will be able to determine the minimum funding required for 1987 and to what extent are these priority shifts of SDIO been required by funding changes by the Congress?

General ABRAHAMSON. Some of them have been required by funding changes and some of them have been the natural evolution of our architectural studies of the progress that we have made in countermeasures work and understanding that and this business of instead of carrying forward all the parallel tasks that were initially recommended by the Fletcher report and which we would have like to have done, because it would have reduced risk in the program, but we did not have enough money, so I felt that I had a responsibility to both the program and to you, and certainly to the taxpayers, to make choices, and so I did.

Frankly, Senator, I am surprised that you would, or that your staff would consider that that is the wrong way to manage the program.

Senator STEVENS. I want to follow through and get an understanding of this concern. We are going out to the laboratories, as you know.

General ABRAHAMSON. Yes; and what you will hear will be reports from several researchers, all with good ideas, but unfortunately some of the programs I have had to cut funding. In some areas that has had a beneficial effect and speeded up their progress, but we did make priority choices, as I think I have explained to you.

For example, we couldn't fund six different directed energy concepts and keep them all in after-burner, just going as fast as we could. So, we made choices. The principle choice is the induction-linac version of the ground-based free electron laser, which we are keeping in after-burner with the reduced funding. Some of the others, such as the space-based chemical laser, I have throttled way back on.

Now, the technical regret is that team of researchers still believes that the space-based chemical laser is a good thing, that it can compete, and in the face of these cutbacks, they have come up with some new technical concepts, even some, not breakthroughs, but some important advances.

So, now I sit here with regret because it deserves some additional funding and I cannot give it to them.

Senator STEVENS. I think the others will have some questions, but I would like to get some of the classified matters here.

You show a 1-year slip in the experimental demonstration for the boost surveillance tracking system.

General ABRAHAMSON. Yes, sir.

BOOST SURVEILLANCE TRACKING SYSTEM CAPABILITIES

Senator STEVENS. Can you tell us what specific capabilities would this boost surveillance tracking system have [deleted].

General ABRAHAMSON. That, by the way, was a very important element of the architecture studies. At the time of the Fletcher Commission and the original examination of the boost phase system—the boost phase system is one where you set a spacecraft in geosynchronous orbit, it would be over the Soviet Union; in fact, there would be a constellation, several of them there, but they are always in that position.

Others would be pointed in certain places around the world where we think the threat is real and where they would normally launch sub-launched ballistic missiles, and some over some of the theater areas that we are concerned with.

Those kinds of systems provide us the initial warning. We do get an initial warning [deleted] and I have shown some of you a tape recording of the information that you get [deleted].

We have, for example, [deleted].

PAYLOAD

Senator STEVENS. Does it register the payload or anything like that?

General ABRAHAMSON. [Deleted.]

Senator STEVENS. This little bar?

General ABRAHAMSON. Yes; this little bar. In order to have a boost phase detection system that would give us aiming capability. It is very difficult technology. Part of our architectural studies is on putting all that capability up in synchronous orbit, then you put in something more at a midrange or lower altitude, if that can be made survivable. That is part of our tradeoff.

The decision on the final version of the boost phase is being made this summer.

BOOST PHASE

Senator STEVENS. Is the distinction between the boost phase and detector system the boost surveillance tracking system?

General ABRAHAMSON. No, sir. When we say "boost phase," we are referring to that satellite in geosynchronous orbit. The original concept of producing that was so that it could be available [deleted], that it would have the technical performance, the higher level of technical performance that SDI might require.

But in addition to that, it would have survivable features, and survivability features [deleted].

RADAR OPTICAL MEASUREMENTS

Senator STEVENS. Are these radar optical measurements that are being taken in my State, Cobra and Queen measurements, are they related to this in any way?

General ABRAHAMSON. They are related to it in one way, sir. Not boost phase. It is more related to the problem of understanding, the ability to tell the difference between a real warhead and a decoy and to tell that during the midcourse phase when you have thousands of objects out there.

What we have done here, we have taken this ship, the Cobra Judy, and we have modified it and added radar capability and added radar discrimination capability.

That is what that program is.

Senator MCCLURE. May I ask a question at this point?

Senator STEVENS. Senator McClure.

BOOST PHASE

Senator MCCLURE. How much of our ability to look at boost phase depends upon our acquisition. over a period of time. of all the data base?

General ABRAHAMSON. For boost phase?

Senator MCCLURE. Yes.

General ABRAHAMSON. I think we have a pretty good data base now. It is good enough now, but it is based upon our measurements of past systems?

Senator MCCLURE. Of past systems?

General ABRAHAMSON. Past systems. We need to be able to continue to do that as they bring new systems onboard like the SS–24 and SS–25.

DATA BASE BUILDUP

Senator MCCLURE. How long does it take you to build that kind of data base to give you confidence that you know what it is that you are looking at?

General ABRAHAMSON. I believe we have confidence before the Soviets have confidence in their missiles. They fire a lot of missiles [deleted].

SURVEILLANCE ACQUISITION TRACKING SYSTEM

Senator STEVENS. I understand this surveillance acquisition tracking system in the 1987 budget is $1.3 billion. We have the breakdown of that.

General Abrahamson. That is for the entire area of surveillance. But that is not for that one satellite.

Senator Stevens. I understand that.

General Abrahamson. It is for [deleted] different satellites, for all those detectors, for the development of what is called the airborne optical adjunct, a very important part of that.

If I might, I would like to show you a sequence for the airborne optical adjunct because it gives us a better understanding of why some of these cost so much.

END-TO-END EXPERIMENT

Senator Stevens. What is the end-to-end experiment, by the way?

General Abrahamson. An end-to-end experiment might be with an airborne optical adjunct and a radar being able to see that you can indeed track and do an entire program.

Another end-to-end experiment would be to take the White Sands laser we have now at the White Sands Missile Range and instead of firing it only against a ballistic missile, thrust up on the ground as part of the lethality test, but to be able to run that laser through a beam director and measure how much of the information we get in space and where it would have to bounce off.

So, it is those kinds of things that we follow in the experiment.

This is one of the programs. This is the schedule for it. You can see a very important thing, that many of these things are coming together in the early 1990's where this is the schedule for this airplane. This might not be the final airplane, by the way. It might be something else in the deployed system, but we are doing it the cheap way.

We are using an existing airplane. This is a test version of the Boeing 767. It was around and it does not cost us anything as part of the proposal to get the airplane, but we had to modify it as a surveillance and tracking alternative, one that provides us the kind of information for the terminal phase.

[Deleted.] That is important, so that the Russians cannot find a simple countermeasure to be able to stop you, [deleted].

AIRCRAFT TURRETS

It is an airplane with a lot of computer power. Up here in the front are two turrets and those turrets have in them an infrared telescope. That is essentially the way to put it.

Some of the progress we are making on that program.

Here is a copy of the turret. This is a little over a $300 million contract. We had a little trouble on this, by the way, and I took early action to contain the cost growth in the program and still meet the objective. This turret has to be fairly big because it has some pretty big mirrors in it and it has to be able to point and track very accurately.

What you want to do is fly above [deleted].

We are not putting all of the detectors in. We are only putting in about a [deleted] of them. We now have a working focal plane with these kinds of advanced state-of-the-art chips today.

This is what will allow us to be able to look out in [deleted].

When I talk about progress—and I hope I am representing this accurately and not misrepresenting—some people measure the progress only in a finished product as that airplane flies. It will not fly for several [deleted], but the progress, the things that we know will make it work, are right here today for testing these kinds of subcomponents. We are testing them and we are seeing that some of them can work and some of them cannot.

Senator JOHNSTON. The only way it is useful is in the [deleted] and also in [deleted].

General ABRAHAMSON. It could be we want it to.

TURRET SCALE

Senator MCCLURE. What is the scale of that turret?

General ABRAHAMSON. Here you can see a man's arm. So, a man stands up about that tall.

Senator STEVENS. What I am trying to get at—and I have to give up my time here and let the others have some questions—to what extent are you using this money in really developing the data base in order to have a means to determine the viability of these systems as you progress?

Is this $1.3 billion a figure in this surveillance, acquisition, tracking; is that the amount that is basic in terms of this concept?

General ABRAHAMSON. Yes. An example is to take this through next year, this program, which is only one of several programs in that surveillance line, that $1.3 billion, we are scheduling at about $94 million. It has a lot of separate individual efforts in it. We had to be able to see that we could see through the boundary layer on the airplane. That meant a lot of wind tunnel tests. We have done it. We know we can do it.

We have created some of the hardware for the systems. Even some of the more exciting things fall in this area, and I guess it is a little hard to understand, but it shows you how we can use simulation as part of these things, too.

This is a simulator. What we are simulating is from the ground looking up to the background of space and seeing warheads and decoys, what it is you will see with that focal plane with those mirrors, and how that information base then gets into a computer.

COUNTERMEASURES

When people talk about countermeasures, we have to work countermeasures as part of this project. Here is some of the progress we are making. This is all done in a computer and we have to be able someday to fly that airplane so that we know this is not a video game, but it indeed is a real simulation of real information. Again, this is why Queen Match and other programs designed to get real information have to go hand in hand with these kinds of efforts.

Now, here is an ideal case. This is when the simulator does not throw anything that confuses it and it shows some signals that we believe would be what we would accurately see, warheads and decoys coming in a string [deleted].

Now, what could the Soviets do? They could put off [deleted].

Now, we simulated that. We know something about it, we do not know it perfectly, but we know something about it. Here is what the computer then would see with normal infrared detectors, not radiation-hardened detectors, but ones that just look up and the kind of detectors we use today.

You can see we have a mess here. Your computer is not going to be able to pick out the warheads and work with the problem. So, that meant we had to go in two different directions and both of these directions are funded as part of this program in one case and another as a separate program.

PROGRAM BREAKTHROUGHS

Part of the program is what we call electronic communications, meaning using electronic data processing to begin to take out the information and get it so that the computer can tell what is there.

The other part is to create hardened detectors that the radiation will not affect. That is one of the key areas that I have called a breakthrough and I believe that is honestly the case.

I only use those words in three separate areas. We have created now infrared detectors that radiation will not affect, that you can use and have a constant signal and background rather than having it all messed up as these pictures show. We have created those.

Now we have demonstrated it and it is critical to this discrimination of targets and decoys and we would put these on those focal planes in AOA. We would also put them on some of those satellite systems.

Senator JOHNSTON. You do not need active discrimination?

General ABRAHAMSON. No, we are not that far. I honestly believe we need active discrimination.

DECOY/WARHEAD DISCRIMINATION

Senator JOHNSTON. How can you tell the decoy from the warhead?

General ABRAHAMSON. I will show you, sir. We can get detectors that are radiation hardened. You can simplify that problem. Remember, this is all in a simulator. Here you can begin to see that just with those hardened detectors that we are making progress.

You can begin to see some of these things, but not with the reliability you would like. Therefore, we add this other feature, electronic mitigation, to it and we see that by taking that messy information and by running through these special computer algorithms that we have developed—here is the nonradiation-hardened detectors and we just did the electronic negation and you can see that we came a long ways, a big step toward that, but there are still false signals in here.

The next step, if you put the radiation-hardened detectors there and then apply electronic mitigation to that, you can see we have really cleaned that up.

The combination of those two techniques is what gives us confidence today, and that is why I have been saying we are making the kind of progress that makes us feel we can accomplish this.

We have not tried that whole path yet. We have not put the airplane together and we are going to have problems with it, but we know that we can build the detectors.

Senator JOHNSTON. In neither of those events can you tell?

General ABRAHAMSON. This is all passive. We can see them well enough. Look at the hot spots, that is what you are seeing. A light decoy does not have the same thermal radiation associated with it as something heavy.

As it goes through its whole flight, the Sun shines on it. It remains hot in a different way and it has a different temperature on its surface than a light balloon, even if the balloon is shaped in the same way.

So, you can see the differences in temperature. Now, that is passive detection. In the beginning and at the time of the Fletcher report, we thought that was going to do the job. It can go a long ways, but it cannot finish it.

Senator SASSER. Mr. Chairman, I am not going to be able to stay for the rest of the hearing. May I ask some questions?

Senator STEVENS. Are they classified?

Senator SASSER. I think they are unclassified.

Senator STEVENS. This is a classified session. If you want the answers to appear in an unclassified area, you should so designate.

Senator SASSER. We will submit the questions, Mr. Chairman. I think there are classified and unclassified questions.

Senator STEVENS. We will be happy to accommodate you.

Senator Proxmire.

Senator PROXMIRE. General, there are three Senators who want to ask questions. It is 7 minutes to 12. I hope you can keep your answers as brief as possible. I am sure your answers are always better than my questions. I hope you can keep them short.

DIRECTED ENERGY WEAPONS PROGRAM FUNDING

Of the $1.6 billion you are asking for directed energy weapons program next year, a billion dollars would go basically to three technology integration experiments which some have called demonstration projects and your office just calls star experiments.

These huge experiments would be for a free electronic laser, No. 1; a neutral particle beam discriminator, No. 2; and tracking and deployment experiment, No. 3.

General ABRAHAMSON. Yes, sir.

Senator PROXMIRE. First, are you not putting a lot of eggs in just three baskets, $1 billion in fiscal 1987 going for just three experiments?

FREE ELECTRON LASER

General ABRAHAMSON. Yes, sir. Let us take the free electron laser. We did not make that choice quickly. Based on the experience that Livermore Laboratory, the Boeing Corp., and others had made in free electron lasers, and we produced, if you recall, and I showed some photographs, the highest efficiency laser that has ever been produced in this country.

It is at a different frequency than the one that we need, but it is based on the progress that has been made. Now, that progress was not just in the development of the free electron laser. It was also in our ability to be able to compensate for the atmosphere.

You will recall do this fall we did very important tests that showed that we could correct for the atmosphere. So, when we put those two things together, that made sense.

Now, it also made sense in the context that it fit well within our architecture. It is the most desirable of the technical concepts.

If I had more money, I would rather have some more eggs in that basket, but I do not.

Senator PROXMIRE. According to the briefing received from the SDI report, the total of each of the experiments were run over several years, a billion dollars or more for each. That is $1 billion or more for free electron laser, $1 billion for the neutral particle beam discriminator, and $1 billion or more for tracking and deploying experiments.

What if those technologies do not pan out?

We are talking here about a colossal amount of money.

General ABRAHAMSON. That is a valid question that you are asking, but it is not a question of not panning out." These are not things like the development of the first atomic bomb where it works or does not work. We already have confidence in these areas.

The question is: "Are we going to be able to get there as quickly and will the final answer have the accuracy levels in the case of tracking and pointing, in the case of the free electron lasers, will we get to the power levels we would like?"

It is not as simple as, can it work or can it not work. We already have confidence that shows us that it will work.

The question is: "Will it be as effective as we would like?"

Senator PROXMIRE. I also notice in the directed energy program that you have cut the budget for basic technology research in order to triple the budget for these technology and laser experiments. You also say in justification that you are making an early decision to pump these huge amounts of money in the three demonstration projects based on current perceptions of each concept's strength and weaknesses.

Then you say that perception could change as you gain further understanding of these technologies.

In other words, you seem to be asking Congress to pump a billion dollars in each of these demonstration projects based on SDI's perception that these technologies will prove useful.

Then you seem to say these perceptions might change in the coming years.

If that is the case, are we not holding the bag for $3 billion?

General ABRAHAMSON. No.

Senator PROXMIRE. Why not?

General ABRAHAMSON. That statement about change is really recognition that there are other concepts that are also attractive that I am funding at a much lower level and that they may be effective at some point in time. But they are not yet. They certainly do not look as attractive as these are and do not fit in the overall system in as attractive a way yet.

But I am just trying to be very straightforward and lay out the fact that there are other options. I do not have enough money to fund all those options equally because there comes a time when you just cannot continue to invest only in basic technology.

You have to put the machine together. When you have to put the machine together, it gets to be a big, expensive, integrated experiment.

Senator PROXMIRE. There is always a chance. I was pleased to read in the justification sheet:

> The Fletcher study concludes economic feasibility of star wars. It may well depend on the capability to significantly reduce the cost of logistically supporting such systems.

General ABRAHAMSON. Absolutely.

Senator PROXMIRE. That is the conclusion that our study came to. Our staff studied it based on interviews with your program managers and concluded we would need a revolution in the way DOD and the defense industry does business in order to produce and maintain a star wars system.

The study raised a question whether that revolution could occur. I note in your justification sheet you also raise that same concern. You say:

> It is not true that there is adequate knowledge, a logistics infrastructure to support a base force of the magnitude and complexity that you envisage.

Would you care to comment on that statement in your justification sheet?

General ABRAHAMSON. We are trying to be revolutionary, sir.

By the way, that is never very comfortable, even for the revolutionaries or the ones that are being revolted against, but we are.

It is in recognition of that logistics problem that I think for one of the first times in system development that we have started off with the logistics operation right in the research stage. I have already brought into my organization logistics officers—and I am not only talking about how do you repair engines, as we are talking about today's logistics—we are talking about logistics which really require changes in the concepts of space transportation, concepts in the way satellites are maintained and upgraded instead of only lasting for a 7- or 8-day period, which is really remarkable today.

So, we are addressing the question and, yes, sir, I do not step back from that statement at all. I agree with the area where your people have echoed what we are saying.

Senator PROXMIRE. The numbers just seem so appalling. As I understand it, we have never lifted more than 1 million pounds in space in a year. We are going to have to lift many times that—30, 40, 50, maybe as much as 200 million pounds in space a year in order to put this into space in 6 or 7 years.

So, it is not only enormously expensive, but there is a real question whether you can do it when you have to have that kind of dramatic change this quickly.

General ABRAHAMSON. That is precisely why, for example, the ground-based free electron laser becomes very desirable. Instead of having to put very large space-based laser battle stations of some kind in, what you have to put up are much smaller, lighter mirrors.They are still complex and it is a fairly large requirement, but much more manageable. As part of our overall integrated systematic thinking that we are trying to approach, this is the most logical manner.

KINETIC KILL VEHICLES

Senator PROXMIRE. In the near term, you are talking about putting up many, hundreds at least, of kinetic kill vehicles, are you not?

General ABRAHAMSON. Yes.

Senator PROXMIRE. Are those very heavy?

General ABRAHAMSON. No.

Senator PROXMIRE. I mean in the aggregate.

General ABRAHAMSON. Now, you have to wait 2 minutes and I will show you the progress that we are making and why I am so pleased with it.

Here is the kind of artist concept that I showed in the past about kinetic kinds of kill vehicles. It is a simple satellite that does not have to point very accurately. It is kind of a garage for a bunch of these very fast rockets, 5 to 8 kilometers per second.

How many we put in any one depends on a whole series of things. That is where we are in concept. The key to that is the interceptor. The key to that interceptor is what finally has to be delivered, this little thing at the front end, the guidance system.

HOMING OVERLAY INTERCEPTOR EXPERIMENT

We demonstrated with the Army in the homing overlay interceptor experiment that we just had to hit to kill something, we do not need an explosion and we do not need a nuclear bomb, then we have this requirement on this kind of system.

Today we are building a [deleted] version of this and it is called the Air Force ASAT. It is darned expensive. We cannot accept that kind of system. So, we are conducting again a series of separate component developments to make this practical.

Today our estimate of how much weight one of these would be if the front end of this was about [deleted] and that is what it would be with today's technology, and we are building a version in TRW of that, [deleted] in the front end, that the total rocket in order to get up to the speeds that we want would be about [deleted]. That is just flat not acceptable.

Senator PROXMIRE. Let me interrupt you again.

I am told that in order to make this hardened and maneuverable, that the flat form would weigh between [deleted].

General ABRAHAMSON. That is absolutely wrong.

Senator PROXMIRE. We were told that in Sandia Laboratory, or the staff was. Were they misinformed?

CORRESPONDENCE FROM SANDIA NATIONAL LABORATORIES

General ABRAHAMSON. I have a letter which you should also have from Sandia Lab. Let me say there is a lot of information that you were given by some people that have preconceived assumptions and do not have the responsibility to direct programs.

I guess I would offer this for the record. This had to do with survivability issues, but it is only one of those kinds of things.

I would strongly recommend and I would be very happy to have your staff people come and talk to the individuals responsible for those sections of the program as opposed to what we are talking about.

[The letter follows:]

LETTER FROM SANDIA NATIONAL LABORATORIES

APRIL 4, 1986.

Senator WILLIAM PROXMIRE,
U.S. Senate,
Dirksen Senate Office Building
Washington, DC.

DEAR SENATOR PROXMIRE: I am concerned about statements attributed to Sandia National Laboratories in the Washington Post's March 30 article on SDI research. The article states that "Scientists at the Sandia Laboratory * * * have come to the conclusion that space-based, boost-phase defense can never be made survivable, unless by treaty." This is not a correct statement of our position on this issue.

Sandia National Laboratories has not reached the conclusion that space-based elements of a strategic defense system cannot be made survivable. No definitive conclusion—especially a negative one—is appropriate at this stage of the research program. Indeed, until we gain a better understanding of the elements of the system that will be based in space, and what their character should be, the only conclusion that we can draw is that survivability should be a major focus of our research.

We acknowledged in our discussions with your staff that the design of survivable strategic-defense space assets will be a challenge; however, our meaning was that this challenge will encourage, not discourage, research. The designing of systems that can survive extreme environments has occupied a great deal of our research effort over the years. Specifically, we have developed technologies for hardening electronics and structures against countermeasures, including a number of designs that experience a space environment. We continue these activities today, with additional emphasis because of the SDI.

In the 3 years since the President's announcement of the SDI, Sandia and other research facilities have made very good progress on this very challenging problem. We would not continue this work if its prospects were as gloomy as the Post article implies.

Sincerely,

IRWIN WELBER,
President.

RESEARCH PROGRAMS

General ABRAHAMSON. In order to make and avoid the kind of situation that we are doing, we are conducting research like this. This is not very exciting, but it is important to us and the engineers get excited about it.

Here is a valve for a rocket, the kind of system one talks about today, the kind of design, about 5 pounds, handling these kinds of systems. Here is a design for one in the future, 10 times less, more than 10 times less.

That is the kind of progress we are making, in order to make those practical new kinds of solid propellant rocket motors.

Let me show you the one I really like, because I think it will make it clear. In every one of those you have to have a guidance system. In every one of those guidance systems you have to have a gyro, an inertial reference frame, something that will work.

SF-16 AIRCRAFT

On the F-16, the program which I directed, we thought we had a pretty modern system. It is about that big and it uses a rotating mass. We have tested these kinds of ring laser gyros and this represents today's technology. We tested it both in an F-15 and it can be used in several of the space applications.

That is the next version and there is an operating ring laser gyro that we are developing to bring down the weight and the cost of those kinds of systems. But we are not just pursuing ring laser gyros. That is an interesting technology.

Here we have invented an entirely new kind of gyro called the fiber optic gyro. It is a coil of fiber optics with a new electronic component on it. Let me show you this one, because it is just a few weeks old and this is rather incredible to me, but here is an entirely new concept of a summit gyro. You can see that it's about the size of a silver dollar. By carrying out those kinds of parallel projects, we believe we can get every one of those interceptors down to on the order of 130 pounds. That is to avoid precisely the kind of situation you mentioned.

Senator PROXMIRE. Thank you.

Senator STEVENS. Senator McClure.

Senator MCCLURE. I have no questions.

Senator STEVENS. Senator Johnston.

FLETCHER REPORT

Senator JOHNSTON. The Fletcher report concluded that survivability is an essentially critical issue whose resolution requires a combination of technologies and tactics that remain to be worked out.

They further say that survivability of these systems, particularly of space-based assets, is a serious problem. As I take it from this letter from Sandia, those survivability problems have not been solved, but it is the focus of the research at Sandia.

General ABRAHAMSON. No, sir. Sandia is only one place in which survivability is going on. Survivability is going on in a large number of our laboratories. It is also going on in some of our companies.

Senator JOHNSTON. It is a major focus of research?

General ABRAHAMSON. It is a major focus.

Senator JOHNSTON. It would be fair to say that the problem has not been solved at this point?

General ABRAHAMSON. I think that is a fair statement. But we know the pathway to get there.

Senator JOHNSTON. The Fletcher report also talks about possible Soviet use of space mines that would trail our SDI satellites and explode on command just prior to a Soviet first strike.

One of the things that is disturbing about the Fletcher report is that it states we must be prepared to shoot first to destroy space mines that are a substantial fraction of the defensive platforms that are under trial.

Do you concur with that, that we have to be prepared to shoot first if they follow up with space-based mines?

General ABRAHAMSON. If we were stuck in that position, sir, I think we would not have done the job as well as we should have. I would like to be able to find means by which we can passively deal with that kind of development so that we cannot become provocative.

That does not mean that there might not be circumstances where the Nation or decisionmakers in the future, if one had such a system, would not want to do that.

Senator JOHNSTON. You would like to find that?

General ABRAHAMSON. No, sir; I have some concepts that are moving very effectively in that direction. They are based on various concepts like the tethered satellites. Tethered satellites could be effective if you combine that with some of the electronic warfare techniques that we use, which are passive, to protect our airplanes today. I do not have the final answer, but I believe that there are, in fact, solutions to the problem.

By the way, if you can use decoys and things like that for warheads, you can use decoys if they want to deploy those kinds of systems as well. So there are countless means of dealing with that.

Senator JOHNSTON. But they are only a concept at this point and they are being researched. We have not solved the problem.

General ABRAHAMSON. They are being researched. They are not solved.

Senator JOHNSTON. That is a key question. It is a question of, "Can you solve that at this point?"

General ABRAHAMSON. We have a lot of confidence in the concept, sir. In some areas we have made a substantial amount of progress. I do not want to imply that the answer is here tomorrow. It is not.

We have to work down and we have to demonstrate some of these things and demonstrate them effectively.

USE OF DECOYS

Senator **Johnston**. On decoys, you say you can put out decoys, but you have shown with passive discrimination you can tell [deleted.]

Why couldn't they do the same with us?

General **Abrahamson**. They could. Therefore, we have to find ways to begin to deal with that and the things that you need to be aware of, sir, is what we are really searching for is where the fundamental advantages lie on the side of defense, and I mean an engineering advantage, a physics advantage, or a cost advantage.

When we are talking about decoys——

Senator **Johnston**. It is a little hard to say who is defending when you have two satellites in the sky and both are shooting at one another. Which one is offensive and which one is defensive?

General **Abrahamson**. We win, in our judgment, if their space mine has to be so complicated and so costly that it begins to approach the cost, or you have to have much larger numbers of the combination of decoys and real satellite systems.

Senator **Johnston**. They can decide when to shoot. That is an advantage.

General **Abrahamson**. Yes, sir; it is.

Senator **Johnston**. General, I missed something up there.

I asked the question, Have you solved the problem of [deleted] and you said, "No; we still need that." But then you said you could tell the difference with [deleted.] They could still have thermal shrouding?

General **Abrahamson**. That is right.

Senator **Johnston**. That is the reason you need——

General **Abrahamson**. And I have shown you where we have been doing testing [deleted.] We need this as baseline, by the way, but you need to be able to have in your technology packet the ability to go to interactive discrimination in order to prevent them from just moving easily in the area of this [deleted].

Senator **Johnston**. You think active discrimination is a necessary element?

General **Abrahamson**. We call it interactive discrimination because it is a combination of passive and some way in which you can probe the system.

Senator **Johnston**. By the way, General, our people have been told, have been given various numbers as to—I understand this is highly classified [deleted.] What is your current thinking about the number of decoys they might be able to deploy?

General **Abrahamson**. I think the [deleted] number is an exaggerated number. I think it is very practical for them to be able to put up in the [deleted].

Senator **Johnston**. [Deleted.]

General **Abrahamson**. Yes; if they felt that was clearly an effective means of dealing with us, then they would probably begin to [deleted], but then, of course, we are winning.

KINETIC KILL VEHICLES

Senator JOHNSTON. General, a moment ago you talked about reducing the size of the kinetic kill vehicles.

General ABRAHAMSON. Yes, sir.

Senator JOHNSTON. Is your conclusion that within existing lift capabilities and cost parameters that we could solve that or do we need something new. And if we need something new, is it something like the Orient Express, the hypersonic aerospace plane?

General ABRAHAMSON. In terms of space transportation even for today's needs, it is too expensive. Even before the *Challenger* accident, we knew we needed something further.

All of our requirements are under review. There are several alternatives that represent an integrated program that is laid out for the President.

Senator JOHNSTON. What other programs would you have besides the——

General ABRAHAMSON. The aerospace plane is one possibility and it may be a very effective one. We can already see if it is deployed and if the technologies work, that somewhere after the year 2000 we may be able to reduce down in the hundreds of dollars per pound in orbit, which is what we would like.

Easier than that job is large boosters, similar to the Saturn V class of boosters. We have a series of those under study and, in fact, Friday I will participate in a joint NASA and Department of Defense committee to look at a series of those options. We are in the process of making those decisions.

Senator JOHNSTON. What kind of deployment date are you looking at?

General ABRAHAMSON. We are not looking at a deployment date now, sir. What we are looking at is what research areas, what technology do we need to invest in so that a future decision can be made about moving into deployment. We need to first ensure that we have the right technologies.

Senator JOHNSTON. What I mean is, if we are going to try to choose technologies by the early 1990's.

General ABRAHAMSON. We could support an [deleted] deployment if we invest now in the research to ensure that those technologies are mature enough. That is exactly the same philosophy we are using in the basic SDI Program.

Senator JOHNSTON. To me, the Orient Express is very exciting, but I cannot imagine a deployment date until well, well into the next century.

General ABRAHAMSON. I believe that that is probably sometime after the year 2000.

Senator JOHNSTON. Thank you.

Mr. Chairman, I have some more questions.

Senator STEVENS. Senator D'Amato.

Senator D'AMATO. I have no questions.

Senator STEVENS. We are still trying to plan this trip for us. We would hope that when we get this schedule, if you do arrange it, that you can give notice to these people that we are coming and, hopefully, you will have someone from your office go along with us.

General ABRAHAMSON. Our people will be ready to respond just as soon as you are ready, sir.

Senator STEVENS. It is our intention to make it a working, fast-moving trip.

Do you have some other questions, Senator Johnston?

Senator JOHNSTON. Thank you, Mr. Chairman.

PATHS OUTLINED IN FLETCHER REPORT

You said your budget request was aimed at getting back to the budget numbers laid out in the Fletcher report which would permit a deployment decision in the early 1990's, development decision in the early 1990's. The Fletcher study outlines two paths.

One is the path of what you would do if you had all the money you needed, unrestrained, and the other is the restrained budget.

Now, the restrained budget leads to deployment, according to the Fletcher study, in the late 1990's, actually a delay of only about 3 years from the crash program.

My question is, Why should we not be following that second path, restrained budget, rather than the crash program?

Two reasons: First, because of the problems with dollars; we do not have enough.

And second, it seems to me we would have greater confidence in some of these development decisions if we had additional time.

General ABRAHAMSON. The argument that deals with that is probably the most difficult single argument I have, because we do not have a date. It is not clear that, in fact, we may be faced with a time of technology change on the offensive forces that you would say we just desperately needed it by 1994, or something of that particular time.

So, we are in a subjective and qualitative area. Really, there are two answers to that question and they are subjective.

The first one is what the Soviets might do and what they are capable of doing. It is quite clear that their technology is moving in such a way, both on offensive missiles and in defensive technologies, that we could be faced as a nation with the beginning of a breakout or, perhaps, a better way of describing it is a slipout from underneath the treaty.

Senator JOHNSTON. That would really be in point defense, terminal defense?

General ABRAHAMSON. Yes, sir; it would be.

SOVIET SDI PROGRAM

Senator STEVENS. Along that line, would it be possible for us to have a briefing on what we know of the Soviet's SDI Program?

General ABRAHAMSON. Yes, sir; we will be very happy to arrange that.

Senator JOHNSTON. I understand the Soviets are pretty good on terminal defense, but we are, if not light years, we are a long way ahead in the other areas of these things you have been talking about.

General ABRAHAMSON. I am not sure that there is a simple accounting of that kind, sir. I think the fundamental advantages on our side in the technology areas we can lead in, but we know the Soviets have been working in these areas for a very long time.

Right now, the Soviets have been working in laser research facilities.

U.S. LEAD IN SDI AREAS

Senator PROXMIRE. We were told this year, in fact, only about 6 weeks ago, by the Under Secretary of Defense for Research, of the 20 most important technological areas, including a number that applied to SDI, that we are ahead in 14, we are tied in 6, and they are ahead in none.

How does that square with the notion that they may, somehow, be ahead of us in this area?

General ABRAHAMSON. I think those were broad general categories that he was talking about. I am talking about specifics, specific areas.

Now, Dr. Hicks obviously knows that we have rejected some of these chemical laser approaches that the Russians have. Right here is at least a candidate—we do not know this for sure, but here is a candidate for an [deleted.] We do not have anything like that.

Senator STEVENS. I am sorry, gentlemen, but I am late for another meeting.

I will put a statement in the record at the end of this testimony that we will reconvene at 10:30 a.m., on Thursday, April 10, tomorrow, for testimony from Robert McNamara and Harold Brown on SDI.

General ABRAHAMSON. Before everybody leaves and particularly Senator Proxmire——

Senator JOHNSTON. Mr. Chairman, I have some questions for the record.

Senator STEVENS. I think the General will be willing to answer your questions so that he will not have to come back.

Senator JOHNSTON. I will submit them for the record.

General ABRAHAMSON. It has been pointed out that I have allowed something to happen that I am not at all pleased with and I want to issue a formal and public apology.

That is, that I allowed, in my impatience in this debate, some of the arguments to develop into an acrimonious argument. That has never been my intent. I take my responsibilities as a public official very seriously and I think that they go well beyond the normal responsibilities of integrity and competence and dedication. They also include the manner in which I approach this institution, and certainly all of you. I want to assure you that, while we may differ sometimes in viewpoint, that I have the utmost regard for the personal sacrifices that all of you in this body make in your position of public trust. Even more than that, for the dignity of your office.

If I have sometimes slipped in my impatience, I am profoundly sorry.

Senator STEVENS. General, we thank you for that. I do not think there is any division in this subcommittee. We are never acrimonious to one another. We have deep respect for one another.

So, I think we understand your problems, once in a while, to have just a little bit of a slip. I have slipped now and then.

SUBMITTED QUESTIONS

There are additional questions from committee members which we will ask you to respond to for the record. They will be inserted in the record at this point.

[The following questions were not asked at the hearing, but were submitted to the Department for response subsequent to the hearing:]

QUESTIONS SUBMITTED BY SENATOR MCCLURE

QUESTION: How important is instrument grade beryllium to the Strategic Defense Initiative?

ANSWER: Beryllium is essential to the current SDI research program. More importantly, full scale development of the strategic defense system envisioned for the future would probably require substantial quantitities of beryllium in different grades. Beryllium has structure/weight properties which make it very suitable for use in missile interceptor structure, propulsion systems, mirror surfaces and other high performance parts. Other uses for beryllium may unfold as the SDI research progresses. It is too early to quantify specific beryllium requirements, but certainly a signficant quantity would be necessary if we reach a national decision in the early 1990's to develop and deploy an operational system. For example, one architecture calls for several thousand space-based missile interceptors with each containing about one pound of structural beryllium, and up to tens of pounds of beryllium as a fuel source.

Question: Isn't the Brush-Wellman Company the only domestic company in the free world that can produce instrument grade beryllium as well as structural grade beryllium?

Answer: Brush-Wellman is the only known domestic company that can produce produce instrument grade beryllium.

QUESTION: I understand that the National Defense Stockpile contains no instrument grade beryllium and further that the President's July 8, 1985 National Defense Stockpile "Modernization" Proposal would zero-out the goal for all beryllium products (i.e. vacuum cast ingots; hot pressed billets). Is that correct?

ANSWER: It is our understanding that the President's modernization proposal retains a portion of the existing stockpile for at least five years, including 290 short tons of beryllium. Further, NSC has recently directed the General Services Administration to acquire 30 short tons of beryllium to result in a better mix of structural and instrument grades in the stockpile.

QUESTION: Would you agree that both structural grade and instrument grade beryllium are strategic and critical materials? Why then is the President zeroing the stockpile goal for both?

ANSWER: The national Security Council issued a directive on June 16, 1986 with the following information:

"As a result of analysis completed by the Departments of Defense and Energy and The Office of Management and Budget, it has been decided that the acquisition of a minimum of 30 short tons of beryllium metal is in the United States security interest, noting that:

-- Beryllium is a critical material used in national defense systems;

-- There is a single major free world supplier, and;

-- Loss of the beryllium plant would terminate production for a protracted period of time.

"It is therefore directed that GSA acquire 30 short tons of beryllium. This procurement should result in a stockpile that contains structural and instrument grade beryllium in such quantities that the sustainability levels for these two types of materials are as equivalent as possible.

QUESTION: The President's July 8th Stockpile proposal reflects that the so-called "Supplemental Reserve" will contain 437 short tons of Beryllium metal equivalent. Since none of this is in useable form (structural and instrumental grade) and assuming that all of it could be upgraded to a useable form, how long would this sustain the U.S. in peacetime and how long would it sustain us in wartime?

ANSWER: For full scale development and deployment of a future strategic defense system, beryllium is certainly a critical material. The recent National Security Council direction for a joint DoD and DoE study on beryllium should serve to identify proper defense stockpile goals. As addressed in a previous answer, the goals for materials in the National Defense Stockpile is under the direct purview of the National Security Council staff.

QUESTION: Considering the fact that the Strategic and Critical Materials Stock Piling Revision Act of 1979, as amended, requires that materials which are strategic and critical be stockpiled in quantities "... sufficient to sustain the United States for a period of not less than three years in the event of a national emergency," how can the Administration justify having no goal for those materials, not to mention that numerous other materials vital to the Nation's security are being zeroed-out as well?

ANSWER: The President's Modernization proposal, which includes proposed goals for a number of materials considered for inclusion in the National Defense Stockpile, is under the direct purview of the National Security Council staff which exercises control over release of information in this matter.

QUESTIONS SUBMITTED BY SENATOR D'AMATO

QUESTION: To what extent is SDIO using existing technology in planning for near-term strategic ballistic missile defense?

ANSWER: SDIO is making extensive analyses of existing technology in planning for near-term strategic defense. The most important factor is determining how these current technologies flow into future systems and provide transition support. For example,, the SDI system architecture studies are identifying those technologies that will be available first, such as kinetic energy interceptors and passive discrimination techniques, for application into the early phase of an evolutionary BMD system.

QUESTION: What contractual work is being done for the near-term solution?

ANSWER: On-going contractual efforts in the technology areas that will be available first support the near-term solution.

Questions Submitted by Senator Stennis

Question: Can you tell us what the weight of the space-based components of an SDI system migh be? Can you give us a high and low range in pounds?

I recognize that undoubtedly new launch vehicles would have to be developed for SID, but looking at launch requirements in terms of current capability is useful.

Answer: Conceptual SDI architectures employing space-based weapons are only one subset of several possible SDI deployment systems. SDIO is participating with the USAF and NASA in a national space transportation and support study, per tasking by the National Security Council (NSC). While SDIO has not selected any baseline architectures, we generated a representatives mission model to drive the NSC-directed study of the various transportation system options that could satisfy potential SDI requirements. The values provided included a total weight (includes payload, upper stage, propellants, and airborne support equipment) to orbit of approximately 58 million pounds for a kinetic energy system which could increase to 80 million pounds when a directed energy system is included. These values were used to stress potential space transportation requirements and would represent the high range. There is no minimum or low range (non-zero) currently identified. Also, these values represents a deployment and operations period of a 23-year duration.

Question: How much launch capability in terms of Space Shuttle mission equivalents might be required to launch an SDI system initially?

Answer: Shuttle mission equivalents is an inappropriate measure to use in defining SDI Launch requirements. The Shuttle is significantly ineffective for the high inclination orbits preferred for SDI architectures employing space-based weapons. However, the Shuttle could satisfy the kinetic energy systems launch requirements from a performance perspective. The number of shuttle launches would approach 2000 - a number that is clearly unacceptable. The use of a launch vehicle system optimized to satisfy the high inclination orbit requirements would signifcantly reduce the number of shuttle equivalent launches. That exact number would be dependent on the specific launch vehicle selected, and could be reduced by an order of magnitude for the the heavy-lift launch concepts

Question: How much launch capability in terms of Space Shuttle mission equivalents might be required annually to sustain an SDI system already in space?

Answer: The "sustaining" requirements are included in the above discussion and the same concern about shuttle equivalent inefficiencies is applicable.

Question: What is your estimate of the magnitude of the SDI equipment flight-testing program that would be required prior to deployment of any SDI system?

Answer: Since SDIO has not selected any baseline architectures and specific satellite elements have not been selected, it is almost impossible to answer this question with any precision. However, the SDIO flight-testing program is curently estimated to require the equivalent of about 3 STS flights per year and ELVs equivalent to 4-6 Thor-Deltas per year (more flights per year if Scout-like ELVs used; less if Titan-class ELVs used). Testing in initial years will be at lower rates.

Question: When will this flight-testing begin and end?

Answer: Flight testing began under SDIO auspices with the Homing Overlay Experiment (HOE) test in June 1984 using ELVs and with the High-Precision Pointing and Tracking Experiment (HPTE) in July 1985 using the Space Transportation System (i.e., Shuttle). Testing is anticipated to continue until the mid 1990s.

Question: What systems have to be fight-tested and to waht extent?

Answer: The SDI is a research program and no decision has been made to begin serious development and testing on space-based systems. We anticipate that it will be another year before the scope of the testing efforts will emerge from the selected system architectures.

Question: What is the magnitude of your current flight program for SDI experiments? How many flights on what schedule?

Answers: SDIO has requested dedicated shuttle missions to support technology experiments at the following schedule:

87	88	89	90	91	92	93	94	95
1	1	1	2	2	3	4	5	5

Question: How many flights have been cancelled or delayed as a result of the shuttle accident, and what is the impact on your research program schedule?

Answer: The current SDI requirement for shuttle flights was specified as the order of one per year between 1987 and 1992. Although the requirement remains fixed, the shuttle accident has modified our approach in several ways:

(a) some flights are being redirected to expendable launch vehicles (ELV's) as appropriate. For example, the High-Brightness Relay (HIBREC) experiment was scheduled to fly on the shuttle in

FY 89. It currently is being configured for a Delta launch vehicle.

(b) some planned dedicated SDI flights will be broken into a number of partial payloads and manifested separately with other DOD and NASA payloads as available. The second Tracking and Pointing Experiemtns (TPE) mission is a good candidate for this approach as many of the experiments are modular in nature and current manifests indicate long slippages for a dedicated full flight.

In summary, although the shuttle accident will certainly cause slips in our earliest missions, we believe that the preponderance of required experimental flights can be accomplished by 1992 using these alternative approaches. The biggest concern will be the phasing of required technology development with a (now) uncertain space test schedule.

QUESTIONS SUBMITTED BY SENATOR SASSER

Question: In a recent report titled 'Soviet Strategic Defense Programs,' released jointly by the Department of Defense and the Department of State in October, 1985, only one power source was mentioned for Soviet laser and other directed-energy weapons, and that was magnetohydrodynamics. Are you familiar with Soviet development of this technology?

Answer: We are quite familiar with the Soviet MHD program. The Soviets have extensive operating experience with both fixed and mobile MHD generators with potential military application. They have developed several rocket-driven MHD systems of various sizes, and are in the process of design and construction for a 572 megawatt commercial power generation plant which combines and MHD channel and a conventional steam turbine plant.

Question: Are you aware that the rocket-driven MHD generator was first tested in the U.S. in 1967 by the University of Tennessee Space Institute and Hercules were the solid propellant rocket motors were developed by C.D. Bangerter, who is now President of REDEVCO, Inc. in Utah?

Answer: We are fully aware of these and other developments in U.S. MHD technology. The manager of the SDIO Power and Power Conditioning program has had several discussions with Dr. Bangerter, Dr. Wu of UTSI, and other experts in the MHD field. These contacts have been very useful in determining the potential applications of this technology within SDIO and in formulating our power program.

Question: How do you account for the fact that while initial development of this important power source was done in the United States, now twenty years later we find the Soviet Union with a developed system capable of producing high power levels and the United States has no counterpart? Would you agree with me that this is an area in which the United States has been surpassed by the Soviet Union and immediate efforts are required by us to at least gain parity with the Soviets if not again surpass them in this critical technology?

Answer: The Soviets have obviously chosen to pursue MHD technology to a greater degree than has been done in the United States. In doing so, they have surpassed us in hardware and operational experience. However, it is not clear whether Soviet capability in the analysis of MHD flow fields and interactions exceeds our own, particularly for high performance machines. At present, we are assessing the relative merits of many options for providing the extremely high power levels necessary for the SDIO mission. MHD is one of the candidate technologies under study, but it may be some time before these decisions can be made.

Question: What are your plans for development of MHD as a prime power source for meeting SDIO's multimegawatt power requirements?

Answer: We do have plans to investigate MHD as part of the multimegawatt power program within SDIO. The multimegawatt effort is essentially a new start in FY 1986, and work in several technology areas is being initiated. An RFP for conceptual design of MHD system for SDIO power will be issued later this year through the Department of Energy's Pittsburgh Energy Technology Center. (This center manages the fossil-fueled MHD program for the Department of Energy.) Should MHD prove to be one of the more promising concepts, this initial design phase will likely be followed by development of test hardware at an appropriate scale.

Question: What level of funding is anticipated in the SDIO budget for fiscal year 1987 for development of MHD systems?

Answer: Funding for MHD depends on two factors: its relative merits compared to other power options and the final appropriations received by SDIO. It is anticipated that between two and four million dollars may be alloted to MHD in FY 1987 power budget.

SUBCOMMITTEE RECESS

[Whereupon, at 12:27 p.m., Wednesday, April 9, the subcommittee was recessed to reconvene at 10:30 a.m., Thursday, April 10, 1986.]

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1987

THURSDAY, APRIL 10, 1986

U.S. Senate,
Subcommittee of the Committee on Appropriations,
Washington, DC.

The subcommittee met at 10:30 a.m., in room SD–192, Dirksen Senate Office Building, Hon. Ted Stevens (chairman) presiding.

Present: Senators Stevens, Kasten, Cochran, Proxmire, Chiles, Johnston, and Sasser.

NONDEPARTMENTAL WITNESSES

Former Secretary of Defense

STATEMENT OF HON. ROBERT S. McNAMARA, FORMER SECRETARY OF DEFENSE

STRATEGIC DEFENSE INITIATIVE

HEARING PROCEDURE

Senator Stevens. This is another series of hearings we are having on SDI to give us the ability to review the President's request for $4.8 billion for the Strategic Defense Initiative for the fiscal year 1987.

Yesterday we had a closed session with General Abrahamson to discuss classified specifics of SDI and other related classified issues.

We are pleased today that two former Secretaries of Defense are here to give their own independent assessments of the Strategic Defense Initiative.

The hearing has been primarily arranged at the request of my good friend from Wisconsin. We will be pleased to listen to the former Secretaries, but before we proceed, I would like to see if Senator Proxmire has an opening statement.

OPENING STATEMENT OF SENATOR PROXMIRE

Senator Proxmire. Thank you, Mr. Chairman.

First I think recognition should be given to you, Mr. Chairman for holding this hearing. The subcommittee will have several hearings on the SDI program this year and I want to commend you for bringing in witnesses on both sides of the issue and for soliciting my recommendations for witnesses.

I am delighted that we have two former Secretaries of Defense with us today whose credentials cannot be questioned.

McNAMARA RECORD AS SECRETARY OF DEFENSE

Robert S. McNamara became Secretary of Defense in January 1961. There are only seven Senators still serving, Mr. McNamara, from when you took over that position—Senators Stennis, Long, Thurmond, Proxmire, Byrd, Burdick, and Pell. I say this because many may have forgotten your first year of testimony before Congress. But I remember it well.

Mr. Chaiman, Secretary McNamara came before the authorizing and appropriating committees without specialized notes, backup charts, and tables. He covered all of the defense programs himself. He answered questions in astounding detail and complexity without recourse to supporting personnel or review of briefing books. The chairman of the House Armed Services Committee, Carl Vinson, and Richard Russell of this subcommittee said they had never, never seen such a performance or command of the subject.

Robert McNamara was an activist Secretary. He said there were two roles for a Secretary to take. He could be passive or essentially judicial in scope. Or he could be active—providing aggressive leadership—questioning, suggesting alternatives, proposing objectives, and stimulating programs. He clearly chose the latter course.

Secretary McNamara grappled with some of the most important strategic and general purpose force level issues of any time including the ABM; MIRV; the B–70; the impoundment of Titan II missile funding; the missile gap; the Minuteman program; questions about the vulnerability of our ICBM's—did some of us think this was a new issue; in fact, it was first raised by Barry Goldwater in the campaign of 1964—the Poseidon program; and the doctrine of flexible response and the counterforce.

It is no exaggeration to say that no other postwar Secretary has been forced to deal with a broader or more important range of strategic questions. None.

BROWN RECORD AS SECRETARY OF DEFENSE

We also will have with us Secretary Harold Brown. The current trend in increased defense spending did not begin, as is commonly asserted, with the advent of the Reagan administration. It began, by any statistical comparison, in the last 2 years of the Carter administration when Harold Brown was Secretary.

Many of the major weapons programs that are coming to fruition under the Reagan administration were initiated and funded under Secretary Brown's leadership including the air, land, and sea cruise missile program; upgrading of the B–52 bombers; the advanced technology bomber; advanced ABM research; the MX missile; funding for nine Trident submarines; command, control, and communications improvements; the MK–12A warhead for Minuteman III; the authorization of 79 general purpose ships delivered during the Reagan administration, including 2 aircraft carriers, 3 destroyers, 9 AEGIS guided missile cruisers, 31 guided missile frigates, 1 amphibious ship, 20 nuclear-powered attack submarines, 15 auxiliaries, and 3 patrol combatants.

Obviously, this list does not include deliveries during the Brown years.

I could go on, but the point is that Secretary Brown presided over a significant buildup in U.S. military power, much of it that actually was delivered in later years.

So, Mr. Chairman, we have two experts on our hands who were in office during periods of substantial military expansion and I welcome their views.

Senator STEVENS. I welcome both as personal friends, even though we might not totally agree.

Mr. Secretary.

Mr. McNAMARA. Thank you, Mr. Chairman.

STATEMENT OF ROBERT McNAMARA

Mr. Chairman and members of the committee, it is a pleasure for me to be with you today to share my views on the SDI and its potential effect on the arms control negotiations and the arms race.

I am very grateful to Senator Proxmire for his kind words. His memory is much more accurate than mine. I hope it is accurate enough to justify the compliments he paid me. I doubt it.

In any event, Mr. Chairman, I have prepared a brief statement. With your permission, I would like to present it, and after that I will be pleased to try to answer your questions.

Senator STEVENS. Yes, sir; please do.

Mr. McNAMARA. One year ago, Messrs. McGeorge Bundy, George Kennan, Gerard Smith, and I published an article in Foreign Affairs magazine entitled, "The President's Choice: Star Wars or Arms Control." In it we said:

> We believe the President's initiative to be a classic case of good intentions that will have bad results because they do not respect reality.

That was my belief then. It is my belief today. The President is attacking the right problem, and I think we should give him immense credit for that, but he is proposing the wrong solution. I will try to explain why.

Let me begin by describing the situation as it is today.

UNITED STATES/SOVIET MILITARY CAPABILITY

The arsenals of the United States and Soviet Union hold, in total, some 50,000 nuclear warheads. Each, on average, is far more destructive than the bomb that obliterated Hiroshima. Just 1 of our 36 strategic submarines has more firepower than man has shot against man throughout history. Thousands of nuclear weapons are ready for immediate use, but just a few hundred warheads could utterly demolish the largest nation.

To deter war, each side seeks to convince the other, and itself, that it is ready and able to wage a nuclear conflict having the military objectives of a bygone age. What is known of Soviet nuclear war plans is open to various interpretations, but those war plans do appear to rely on tactics derived from Russia's prenuclear military experience. And so do ours.

Our current U.S. defense policy calls for nuclear forces that are sufficient to support a controlled and protracted nuclear war, that could eliminate the Soviet leadership, and that would even permit the United States to prevail.

The nuclear warfighting notions of each side have led to enormous target lists and huge forces. Our 11,000 strategic warheads are directed against some 5,000 targets. And NATO's European war plans are based on early first use of some 6,000 tactical nuclear warheads in response to a Soviet conventional attack.

Warfighting doctrines create a desire for increasingly sophisticated nuclear weapons and warfighting doctrines also lead to routine training of both Warsaw Pact and NATO in their use.

Today both sides are committed to weapons programs that will threaten a growing portion of the adversary's most vital military assets with increasingly swift destruction.

These armories and war plans are far more than macabre symbols for bolstering self-confidence. Moscow and Washington both presume that nuclear weapons are likely to be used should hostilities break out. But neither knows how to control the escalation that would almost certainly follow.

Surely, then, it is reckless to stake a nation's survival on detailed plans for something about which no one has any idea. I submit to you that it would be vastly more reckless to attempt a disarming first strike. Nevertheless, the arms race today, and in particular SDI, is driven by deep-seated fears held by each side that the other has, or is seeking, the ability to execute just such a strike.

SCENARIO OF SOVIET FIRST STRIKE

Those U.S. leaders, and I think they are in the majority of the experts, who believe the Soviets possess a first-strike capability envisage the following scenario:

They believe that the large force of increasingly accurate Soviet missiles could, at one stroke, eliminate most of our Minuteman ICBM's; that our surviving submarines and bombers would only be able to retaliate against Soviet cities; but they think we would not do so because of our fear of a Soviet counterattack on our urban population; and thus believe we would have no choice but to yield to all Soviet demands.

Those who accept this first-strike scenario assume that Soviet leaders would be confident that their highly complex ICBM systems, which have only been tested individually in a quiet environment, would perform their myriad tasks in perfect harmony during the most cataclysmic battle in history.

They are confident also that our electronic eavesdropping satellites would detect no hint of the intricate preparations that such a strike would require.

And they are confident, as well, that we would not launch our missiles when the attack is detected.

The Soviets would believe that the thousands of submarine-based and airborne warheads that would surely survive would not be used against a wide array of vulnerable Soviet military targets.

Finally, those U.S. experts who believe in the Soviet first-strike capability assume Soviet confidence that we would not use those vast surviving forces to retaliate against the Soviet population, even though tens of millions of Americans would be killed by the Soviet attack on our silos. Only madmen would contemplate such a gamble. Whatever else they may be, I do not believe the Soviet leaders are madmen.

SCOWCROFT COMMISSION

That a first strike is not a rational Soviet option has also been stated by the Scowcroft Commission. That Commission, which was appointed by President Reagan, found that no combination of attacks from Soviet submarines and land-based ICBM's could catch our bombers on the ground as well as our Minutemen in their silos.

And it believed our submarines at sea, which carry a substantial percentage of our strategic warheads, are invulnerable.

Despite all such facts—and I want to emphasize this point—I believe the majority of experts in Washington, including, for example, Messrs. Weinberger, Nitze, Kampleman, and Brzezinski, consider the Soviets have, or are seeking to achieve a first-strike capability. So, while I believe it is a misperception, it is a reality we must take account of.

The Soviets appear to hold similar views about us. Americans often find this incredible. They cannot understand how the Soviets could suspect us of such monstrous intentions, especially as we did not attack them when we enjoyed overwhelming nuclear superiority as we did in the 1960's and 1970's.

In 1960, for example, the time I became Secretary, the end of the year, we had 6,300 strategic nuclear warheads to the Soviets' 200, and as recently as 1975 we had 8,000 to their 2,700. Nevertheless, the Russians distrust us deeply. They know that a first strike was not always excluded from U.S. strategic thinking, and they have never forgotten Hitler's surprise attack.

The warfighting mania and the fear of a first strike is eroding confidence in deterrence. Though both sides are aware that a nuclear war which engaged even a small fraction of their arsenals would be an unmitigated disaster, each is vigorously deploying and developing new weapons systems that it will view as highly threatening when the opponent also acquires them.

NUCLEAR SUBMARINE CAPABILITIES

Thus, our newest submarines will soon carry missiles accurate enough to destroy Soviet missile silos. When the Soviets follow suit, as they surely will, their offshore submarines will, for the first time, pose a simultaneous threat to our command centers, our bomber bases, and our Minuteman ICBM's.

ADMINISTRATION STRATEGIC POLICY

President Reagan has said repeatedly—and I think he is absolutely correct, "A nuclear war can never be won and must never be fought."

That, I think, is the foundation of his strategic policy and it is one that I strongly support. However, the absurd struggle to improve the ability to wage the war that must never be fought has shaken confidence in our ability to avert that war.

The conviction that we must, therefore, change course is shared by groups and individuals as diverse as the freeze movement, the President, the Catholic bishops, the bulk of the Nation's scientists, and the President's chief arms control negotiator.

All are saying directly or by implication that nuclear war has served no military purpose whatsoever. They are not weapons. They are totally useless except only to deter one's opponent from using them. That being said, the consensus dissolves for the changes of direction being advocated follow from very different diagnoses of our predicament.

The President's approach is to launch the Strategic Defense Initiative, the creation of an impenetrable shield that would protect the entire Nation against nuclear attack and would, therefore, permit destruction of all offensive nuclear warheads.

The President and the Secretary of Defense appear to remain convinced this strategic revolution is attainable, but virtually everyone else associated with the SDI now recognizes that such a leak-proof defense, should it ever prove feasible, is so far in the future it offers no solution to our present dilemma and, therefore, they advocate other forms of ballistic missile defense and these alternatives range from defense of hardened targets—for example, vulnerable missile sites or command centers—to partial protection of our population.

STAR WARS I AND II

For the sake of clarity, I want to call these alternative proposals Star Wars II to distinguish them from the President's original proposal, the leak-proof shield which I am going to call Star Wars I.

It is essential to understand that these two versions of Star Wars have diametrically opposite objectives. The President's program, Star Wars I, if achieved, would substitute defensive for offensive forces.

In contrast, all Star Wars II programs have one characteristic in common: They all would require that we continue with offensive forces, but the defensive forces would be added to these.

And that is what causes the problem. The President was the first to recognize this. In a little remembered sentence in that speech of March 23, 1983, when he introduced Star Wars, he said, and I quote:

> If, on the other hand—meaning if we did not have a leak-proof system—If, on the other hand, paired with offensive systems, [defensive systems] can be viewed as fostering an aggressive policy, and no one wants that.

The President was concerned that the Soviets would regard a decision to supplement our offensive forces with defensive as a way for the United States to achieve a first-strike capability. That is exactly how the Soviets are interpreting our program; that is why they say that there will be no agreement on offensive arms until we give up Star Wars.

DISARMAMENT TALKS AT GENEVA

Now, does that mean there is no hope at Geneva? Not necessarily.

Paul Nitze faced this problem squarely in a truly remarkable speech made in Philadelphia on February 20 of last year. He said at that time a strategic defense system must meet three criteria before its deployment can be justified. He said it must be effective, survivable, and cost effective at the margin.

TIME PERIODS ON ARMS CONTROL NEGOTIATIONS

He went on to say that no such system would meet these tests soon. Therefore, as far as the arms control negotiations are concerned, Nitze foresaw them dealing with three periods.

The first phase which would last at least 10 years, would be one in which no defensive systems would be deployed and we would, in his words, "reverse the erosion of the ABM Treaty."

The second phase would be a transition period in which some form of Star Wars II might be deployed alongside of our offensive weapons. The second phase, he thought, would last for at least several decades. It might ultimately be followed by a third phase if Star Wars I might prove technically feasible.

Why did Nitze place such emphasis on the ABM Treaty during the first phase? He did so because the treaty recognizes, as he did, that not only the deployment, but even the development of strategic defenses would stimulate an offensive buildup.

Were the treaty to collapse, we could not move toward our goal of reducing the offensive threat.

As you know, the treaty severely restricts the testing of components of the system. Within the near future the United States will almost certainly be violating these restrictions if we place our research program on the time schedule implied by the statements of the director of that program.

General Abrahamson said, for example, "A reasonably confident decision" on whether to deploy Star Wars II could be made by the end of the decade or in the early 1990's. If we are unwilling to refrain from the tests associated with such a schedule, the Soviets will, with good reason, assume we are preparing to deploy defenses. They will assiduously develop their response and the prospect for offensive arms agreement at Geneva will evaporate.

When Mr. Nitze discussed the second phase of what he considered to be a new arms control regime, a phase in which a defensive system would be deployed alongside the offensive system, he acknowledged that the problem of how to write an arms control agreement governing that phase, an agreement that would limit offensive arms, but permit defensive arms, had not been solved and he said to write such an agreement would be, in his words, tricky.

But, by implication, he was saying this is an issue for the future and need not prevent progress at Geneva.

ROLLCALL VOTE

Senator STEVENS. Could we go off the record? That is a rollcall vote. I think the last part of your statement we can take up when we come back.

Could you wait just a few minutes.

Mr. MCNAMARA. I will be very happy to wait for you, sir.

[Recess.]

OFFENSIVE ARMS LIMITATION

Senator STEVENS. Mr. Secretary, we thank you for your courtesy. It is just a necessary fact of life that we must go vote. I am pleased to have you continue.

Mr. MCNAMARA. It will take only 2 or 3 minutes, Mr. Chairman, and I will finish.

I wanted to emphasize, Mr. Nitze in that remarkable speech in Philadelphia on February 20 last year did not address in any significant way the issue of offensive arms limitation. This will be a very complex problem.

As I emphasized, each side has the fear that the other has, or seeks to obtain, a first-strike capability. At present, deterrence is unstable because of those fears. The great danger is that in a period of high tension, one side or the other would be tempted to launch a preemptive attack.

The primary objective of offensive arms negotiation, therefore, must be to increase the stability of deterrence by eliminating the perception of first-strike threats. As a matter of fact, I think that is the objective of most supporters of SDI.

Because of asymmetry of forces, this will be very difficult to accomplish through offensive arms limitation. It will require that each side reduce the ratio of the number of its warheads to the number of the other side's vulnerable missile launchers.

DEEP CUTS IN NUCLEAR STRATEGIC WARHEADS

In other words, what are needed are deep cuts, on the order of 50 percent; deep cuts in the number of nuclear strategic warheads, but cuts shaped to remove first-strike fears. It would be reasonable, for example, for the United States to insist on large reductions in the number of Soviet ICBM warheads, but in the bargaining we would have to be ready to make substantial cuts in our counterpart forces, including our new, very accurate submarine-based D-5 missiles.

Deep cuts shaped to eliminate the fear of disarming strikes are feasible. They could be negotiated. Will they be? I can only hope so.

We are facing a plus-sum game, a game in which both sides can emerge as winners. Whether or not we do so will depend on whether we continue to adhere to the letter and the spirit of the ABM Treaty. That will require that we shape the SDI program to what the President has always claimed it to be, a research program to be carried out in accordance with the terms of the treaty.

Mr. Chairman, that completes my statement. I will be very happy to try to answer your questions.

Senator STEVENS. Thank you so much.

RESEARCH STATUS OF SDI PROGRAM

So far SDI is strictly a research program, is it not?

Mr. MCNAMARA. As far as I know, it is, Mr. Chairman. The problem is that it is not spoken of that way. I think the words differ from the act.

Senator STEVENS. I think we ought to limit ourselves to 10 minutes because we will have good attendance this morning, I believe.

SOVIET RETURN TO BARGAINING TABLE A RESULT OF SDI

The Soviets left the bargaining table in Geneva. They came back to the bargaining table in Geneva after SDI was announced.

As one of those who was cochairman of the Arms Control Observer Group, it is my personal opinion that the major compelling force that brought them back to the table was, in fact, SDI. In fact, perhaps the broad scope of the announcement by the President of the SDI goals had much to do with that.

I am not asking you to agree with me, but would you not agree that in the course of negotiations such as going on at Geneva, for the Chief Executive, Commander in Chief, to ask us to commit 1.5 percent of the total defense budget to a specific program, which was so intertwined with the Geneva negotiations and, in his opinion, the highest priority in the budget, is that not a reasonable request from a Chief Executive, particularly keeping in mind that it still is for the first 5-year period totally dedicated to research?

Mr. MCNAMARA. Mr. Chairman, I do not know what brought the Soviets to the arms control table. However, I am prepared to accept that what you say is correct; that is, they were brought to the bargaining table by fear of the SDI. If, in fact, it is the bargaining chip that has been implied by your statement and by the President's statements, I say let us bargain. I would say let us bargain and get as much as we can gain in return for reassuring the Soviets that the SDI will be limited to research.

DOD STATEMENTS ON SDI

Senator STEVENS. If it is on the table in Geneva as a portion of the thing to be negotiated, which I think we would all agree on the total objective of success at Geneva, can you tell me, is there anything that has been done in SDI today that would be contrary, to your knowledge, that would be contrary to a concept that SDI along with all other portions of the strategic and intermediate nuclear forces and the whole defense in space concept that were subject to negotiations, has anything been done so far today that, in your opinion, would deter us from achieving the goal of a comprehensive arms control agreement with the Soviets that would in fact lead to a period of reduction of these nuclear weapons that we both abhor?

Mr. McNamara. Yes, sir; there has been.

Senator Stevens. What is that?

STATEMENTS ON SDI PROCEDURE

Mr. McNamara. The Defense Department's statements indicate it is the administration's firm intention to proceed as rapidly as possible with the development and the deployment of an antiballistic missile defense. Furthermore, high DOD officials have said they do not believe the ABM Treaty is in our interest.

Now, those two sets of statements, and they are repeated continually, are contrary to the President's indication that the SDI is only a research program. But the statements are on the record.

Senator Stevens. I understand that.

I want you to know if I were in Max Kampleman's spot as Ambassador in charge of negotiations, I would be pleased that such statements were being made because it would help convince the Soviets of the urgency of negotiations and the urgency of proceeding to try to obtain an agreement.

It looks like we are going to see some progress in INF. I think we will. Maybe not as soon as some people want. It took 4 years for SALT I and 7 years for SALT II.

A lot of people think we should have an agreement already on this most comprehensive negotiation in history. I do not share that opinion.

I do believe, Mr. Secretary, that a President has the right to ask Congress to accord him his first priority in the whole defense budget, particularly so long as it is still research and particularly when it is so intertwined with those negotiations.

I do not find great disagreement with your statement if we were beyond research.

Mr. McNamara. And to ensure that we will not go beyond research, I hope the Congress will, in the legislation appropriated for fiscal year 1987 funds for SDI research, indicate that those funds will be used only for research and strictly in accordance with the provisions of the ABM Treaty, as the President has promised.

Senator Stevens. I think we could assure you of that.

Mr. McNamara. I would like to see it in the legislation.

Senator Stevens. I have no problem about that, but I do believe that the President's request ought to be granted. I think we ought to continue this massive research project, particularly in light of what we have had indicated to us now, and we will have a subsequent hearing again, unfortunately a classified one, on the total knowledge that we have developed to date of the Soviets' research and now apparent development of some of the items of their research, particularly in their laser field.

Does that not disturb you in terms of the overall arms control picture?

U.S. LEAD IN ABM RESEARCH

Mr. McNamara. Mr. Chairman, I believe—and I think the Defense Department authorities, General Abrahamson and others will agree—on balance, we are ahead of the Soviets in ABM research.

The foundation of the ABM system is information acquisition, control, and analysis. We are way ahead of them in that.

LEVEL OF SDI FUNDING

I want to suggest to you that the SDI research program at the requested level of $4.7 billion in 1987 is overfunded and misdirected.

I would continue a strong SDI research program. But I would reduce the cost below what the administration has proposed and reduced the research program.

Senator Stevens. The budget progress will undoubtedly reduce it again. I hope we fund the level of the budget. The current level of funding, $2.7 billion, is that level excessive, in your opinion?

Mr. McNamara. I would spend roughly that amount of money but I would spend it in more effective ways.

Senator Stevens. Again, those of us who have known your career and observed it and been in meetings with you have great respect for your judgment and I appreciate the fact you were willing to take the time to come and make a public appearance and express your views.

Senator Proxmire.

Mr. McNamara. Before Senator Proxmire starts, may I say one thing, Mr. Chairman?

Earlier, before you came into the room, I said to one of your colleagues, if I had my career to do over again—I appreciate your complimentary remarks—I would change it in one major aspect. I would run for elective office. I probably would not be elected, but I would try.

I have tremendous respect for what all of you are doing for the Nation. I want to say that.

Senator Stevens. Thank you very much. I am sure we appreciate that, too. We are envious of your career, however.

Senator Proxmire. In more ways than one.

Senator Stevens. The financial aspect. [Laughter.]

Senator Proxmire. Nobody in the Senate works harder to give us our just dues than Senator Stevens.

STAR WARS AS SUPPLEMENT TO ARMS CONTROL

Mr. McNamara, could Star Wars conceivably be developed and deployed to supplement arms control by giving both sides greater assurance of protection, for instance, by increasing stability, by promoting an option to nuclear retaliation in the event of an attack?

Mr. McNAMARA. Senator Proxmire, the experts supporting the SDI, and I would certainly include Mr. Nitze among those, state that Star Wars cannot be deployed other than within the context of an arms control agreement. That arms control agreement must have two major parts.

The first part would call for a substantial reduction in offensive forces, let us say a 50-percent reduction, bringing our total strategic warheads from 12,000 to 6,000.

The second part must then state that our offensive force of 6,000 must be sufficiently large to survive a Soviet strike and survive with sufficient power to then penetrate the Soviet defense and penetrate it with sufficient power to inflict unacceptable damage on the Soviets, we will permit the Soviets to deploy a defensive force with a kill capability of *x*.

Now, I submit to you no human being knows how to define *x*. We do not know how to specify the size of defensive forces which, in association with offensive forces of 6,000 warheads, would maintain deterrence and assure crisis stability. Yet the Kissingers and Nitzes and Brzezinskis all agree that that kind of arms control agreement is absolutely essential as a foundation for deployment of the SDI.

The only person who has publicly recognized the difficulty of that and who has stated publicly the difficulty is Nitze and that is why he called such an agreement and the transition period tricky.

He does not know how to write the agreement. Neither do I and neither does anybody else. Therefore, the absolute foundation for maintaining strategic stability with deployment of the SDI is lacking and I think unattainable.

DIFFICULTY IN WRITING SDI-INVOLVED TREATY

Senator PROXMIRE. You think there is no way of negotiating limitations on SDI along with limitations on offensive arms?

Mr. McNAMARA. It is not so much negotiating. I have not reached a point where I can conceive of a proposition to put forward. I cannot conceive of how to write such a treaty.

Let me continue to point out the difficulties. The first paragraph, the treaty will say we will cut the offensive force 50 percent down to a total of 6,000.

The second paragraph will say that to insure our offensive force of only 6,000 warheads will remain a deterrent force capable of inflicting unacceptable damage on the Soviets in the event they strike us, the Soviets defensive system cannot have a kill capability greater than *x*.

I do not know how to determine *x*, but if you have that decided, the third paragraph then has to say because we believe the Soviets cheat to insure that the kill capacity of their system is x and not $2 \cdot x$, the system must be designed in accordance with the following design criteria which we know will provide only a capacity of x.

No one knows how to write such specifications. We do not know the kill capacity of our own designs.

By the way, because the President recognizes we must know the kill capacity of the Soviet defensive system he has said we will share our technology with the Soviets. By that means, we will ensure they have the same system we have and they will have the same defensive capability. That is absurd.

Do you think this Nation would or should provide the Soviets the most advanced technology we have. Technology which we do not now have but are developing; technology could be used for strategic defense; for strengthening strategic offense; to strengthen conventional offensive and defensive forces; and to achieve product leadership in commercial markets?

We would not license even the sale of personal computers to the Soviet Union a year or so ago. It is absurd.

LIMITED ABM SYSTEM UNDER McNAMARA

Senator PROXMIRE. When you were Secretary of Defense, as I recall, you favored for a while—perhaps I am wrong and I hope you will correct me if I am—that you favored an ABM system on the ground, to some extent, limited ABM system, to protect us against a third-country attack, possibly at that time from China or some other country.

Is that correct?

Mr. MCNAMARA. Senator Proxmire, you are half right and I blush to say you are half right.

I think the best statement against ABM systems that has ever been given, if I may say so, was given by me in San Francisco in September 1967. Without question, it was the most powerful argument against ABM systems ever given.

However, the last paragraph said, in effect, "Despite everything you have heard before, we are recommending what might be called a light Chinese-oriented system." Why did we do it? Because the Soviets were refusing to negotiate an ABM treaty, and the Congress a year and a half before had authorized and appropriated funds for the start of a heavy ABM system. We were trying to prevent further support by the Congress of a heavy system.

We never should have supported even a light defense. It was a stupid thing to propose.

Senator PROXMIRE. You have never done many stupid things.

Mr. MCNAMARA. Well, I have done more than my share.

Senator PROXMIRE. The President has tried to convince the Soviets that the Star Wars is a truly defensive system. It will never be used to enhance the strike capability of the United States.

Do you think the Soviets will be convinced that the U.S. Star Wars system will be truly defensive?

Mr. McNamara. No; nor would we be convinced if they were doing the same thing.

Secretary Weinberger in the report he sent to the President just before the President went to Geneva, made a very, very important statement, one that I agree with. He said that if the Soviets were even probably moving toward deployment of a nationwide ABM system, we should expand our offense.

That is what President Johnson told Kosygin in Glassboro in 1967. That is what we started to do. That is how MIRV's started. That is exactly what we should do today if the Soviets move to deploy a nationwide ABM system.

FEASIBILITY OF STAR WARS I

Senator Proxmire. One of the concerns of those of us in Congress is that we will eventually realize that a comprehensive Star Wars shield, Star Wars I, you call it, is simply not feasible, then there will be a big push to deploy a hard defense of our missile silos.

What kind of danger do you see if that happens if we end up with hard-point defenses which enhance our offensive capability?

Mr. McNamara. The administration has said categorically that hard-point defense is not the objective of Star Wars.

However, if we ever do deploy Star Wars, I believe it will be for that purpose.

DEFENSE OF MINUTEMAN SILOS

Some would argue we should defend our Minuteman silos.

I am strongly opposed to it. The Scowcroft Commission said it was not necessary. The reason I am opposed to it is threefold.

First, the cost would be horrendous.

Second, I can achieve the same objective—survivability of our retaliatory force—at much less cost and with much less political risk.

And, third, were the Soviets to be permitted, as they would have to be under an agreement that would authorize us to defend our hard-point sites, were the Soviets to defend their hard-point sites, we would fear that such a defense would give them a first-strike capability.

The Soviet hard-point sites are so mixed up with their population centers that were they to defend the hard points, we would believe they were also defending populations and thereby achieving a first-strike capability. That would be very dangerous.

So, I am opposed to it for all three reasons.

You might ask how can I achieve the same objective at lesser cost and less risk? The answer is by doing what the Scowcroft Commission pointed to, which is to reduce the apparent Soviet first-strike threat to destroy our Minuteman missiles.

How do you do that? By reducing the number of their accurate strategic warheads targetable on our vulnerable launchers. That can be done and that should be done as part of our arms control negotiations. If we cannot achieve such an objective, I would not come to an agreement.

U.S. ABROGATION OF ABM TREATY

Senator PROXMIRE. It is obvious if we proceed with Star Wars, the United States will violate and eventually have to abrogate the ABM Treaty. There is a big argument around this town about when that will happen, but the fact is it will happen eventually if we proceed with Star Wars as the administration wants us to proceed.

What consequences do you see for United States national security, arms control, and nonproliferation goals if we proceed with Star Wars and as a consequence, break out of the ABM Treaty?

Mr. MCNAMARA. The consequence will occur long before we break out. The Soviets today believe that we are moving in ways such that at a time favorable to us we will unilaterally abrogate the ABM Treaty and place them at a strategic disadvantage.

As I said earlier, we are ahead of them on balance in ABM research and we have a much greater technical capability than they have. We continually shoot ourselves in the foot by stating the Soviets are superior in A, B, C, D, E. They are not superior in relation to ABM and they know that. They fear if we proceed as we are, that we will unilaterally abrogate that treaty.

Therefore, they are not going to wait until we unilaterally abrogate to begin to respond. They are beginning to respond today. There is no question about it. They are expanding their countermeasure program. They are getting ready to expand their offensive forces.

They will not wait. Nor would we if they were moving the way we are. There will never again be an offensive arms limitation agreement as long as we leave the Soviets with the feeling that we are going to unilaterally abrogate the ABM Treaty at a time favorable to us and thereby put them at a strategic disadvantage.

In our own interest, we must preserve that treaty both in fact and in spirit. But we are not doing so.

Senator STEVENS. Gentlemen, we do have Secretary Brown here also. We have set a 10-minute limitation. If we continue that, we will not be able to hear Secretary Brown at this time.

I think in fairness to Secretary Brown, we have to determine how much time each of you would like to have in regard to Secretary McNamara.

Senator KASTEN. I will skip my questions for Secretary McNamara.

Senator STEVENS. Do you have any idea we will be brief enough that we should ask Secretary Brown to wait?

Why don't we just turn off the clock. You ask any questions that you consider to be reasonable.

Mr. MCNAMARA. I will try to be brief, sir.

BARGAINING CHIP STATUS OF WEAPONS SYSTEM

Senator JOHNSTON. Secretary McNamara, I want to congratulate you on the power of your words and the clarity of your thought. You said what I would have said if I had thought of it first.

I want to tell you this whole business of arms control disturbs me, first of all, because of the use of bargaining chips. I have been here now long enough to see the bargaining chips come and rarely be played.

I have been urged to be for the Trident submarine and I am for the Trident submarine for its own reasons, but I have been urged to be for that for bargaining chip reasons, for the MX for bargaining chip reasons, and now for SDI for bargaining chip reasons.

I do not see those being played as bargaining chips. If they are, the time is now to play them. In any event, to me our arms control direction is misdirected, to me, because it seems to be almost exclusively with numbers as opposed to what I would regard as stability, stability being the absence of the fear of first strike which, to me, is the whole problem in nuclear arms.

My worry is not that they have too many strategic nuclear weapons. While they do and while we do, half that many is more than enough to do the job. What I worry about is in a time of crisis that our planners or their planners would be overcome with fatigue and with anger and fear, or whatever, and pull the trigger because of the fear of first strike.

First of all, do you agree with that?

Mr. McNamara. Yes, sir; I do.

INSTABILITY CAUSED BY SDI

Senator Johnston. Second, does not SDI, whether you have finally the complete astrodome, which I think is a dream that will never be achieved, but all during that development period does that not increase destabilization or does it not destabilize things by worrying the Soviets that we are acquiring the capability to blind their satellites or to otherwise have technologies which enhance our first-strike capability? Therefore, doesn't SDI really work in exactly the opposite direction of what the President has claimed for Star Wars?

Mr. McNamara. Senator Johnston, that is exactly the foundation of the problem. I visited Los Alamos and other labs. I told the scientists, "This is not a technical problem."

They said, "Do you mean we cannot increase the efficiency of the previous ABM design?"

I said, "Of course you can. That is not the issue." If you do increase the efficiency we still haven't achieved our objective which is to increase crisis stability.

Now, no well-informed, coolly rational political or military leader would ever initiate the use of nuclear weapons despite the fact that NATO strategy calls for it. I am positive of that.

That is as true of the Soviet leaders as it is of the Western leaders. But political and military leaders, those I have associated with, including myself, have neither been well informed nor coolly rational in moments of crisis.

The great danger, therefore, is that we move in ways with respect to our weapon systems and particularly our nuclear weapon systems, that increase crisis instability instead of strengthening crisis stability.

You are quite correct, in my opinion, in stressing that an increase in crisis stability should be the objective, not a reduction in numbers of weapons.

I happen to think you can achieve both, but the important objective is increasing crisis stability. We must ensure that in a moment of crisis when leaders are only partially informed as to an enemy's intentions or as to his actions, when emotions are running high as they invariably do, at that moment in time we do not confront an enemy who feels that he would be better off if he attacks first because he is certain you are going to attack. The fear of attack and the stimulus to preemption is the greatest danger in the nuclear age.

SDI will increase that fear. It will increase crisis instability and that is, from my point of view, the great danger.

Put aside the cost. We are a wealthy society. We can afford $1 trillion if it strengthens us. I am in favor of spending whatever we need to protect this Nation.

My concern is that this will not protect the Nation. It is going to endanger it. It is going to endanger it because it will increase each side's fears of a first strike. At a time of crisis, that leads to instability and the danger of preemption.

Senator JOHNSTON. Of course, we can engage in a robust research program properly structured that would not be destabilizing.

Mr. MCNAMARA. That is correct.

COST PARAMETERS OF SDI

Senator JOHNSTON. Would you like to give an estimate—I think Secretary Brown has and Dick DeLauer has and others have, of the parameters of cost of SDI.

Mr. MCNAMARA. Secretary Weinberger said, and I think quite correctly, you cannot estimate the cost of a system that has not been designed. I would go further and say neither should you be planning to deploy a system that has not been designed.

Not only has the system not been designed, I would go further and say it is a system whose objective has not yet been formulated. We are still unclear whether we are talking about a leak-proof system, Star Wars I, or a leaky system, Star Wars II. These have different costs.

Let us assume we are talking about deploying the only kind of system that will be practical in the next three or four decades, Star Wars II, a leaky system. Still there are many, many forms of Star Wars II.

There is a form that would defend only hard-point sites and there is a form that would defend hard-point sites and provide as well a partial defense of populations. The administration says they are not interested in defending hard-point sites. If they were, I would guess it would cost $300 billion. I base that figure on the cost of the system we were talking about in the mid-1960's, which in those days, while providing a much less robust defense of hard-point sites, would have cost about $30 billion.

It would probably end up, as most defense systems do, costing far more than they estimated. Forgetting that, take that $30 billion system, strengthen it to the robustness that would be associated with today's hard-point defense, add inflation, and you are up to $300 billion.

If you go beyond that and introduce partial population defense, you are in the range of $500 billion or $1 trillion—very likely in the high end of the range.

Senator STEVENS. Senator Chiles.

Senator CHILES. Mr. Secretary, we are delighted to have you here. We were saying on the car going over to vote last time, we were kind of reviewing your career, we are delighted to see that in spite of the time in which you served, you continue to have this great interest and you continue to speak out from your experience for your concerns for the country. We are delighted to see that.

STAR WARS I AND II CONTROVERSY

You talk about Star Wars I and Star Wars II. The American people seem to think, and I think they are convinced when we talk of Star Wars, that we are talking about Star Wars I. That is what the President articulated in his speech and that is what has been said.

We are talking about this leak-proof shield. Yet there continues to be the discussion as to whether, one, that is one that can ever be accomplished and, two, whether we can ever pay for it if we could accomplish it.

I just want you to embellish a little bit on the concept and ask you, do you think Star Wars I is still the goal of everyone in the administration or do we have the President articulating that goal and others are out really sort of working on a track that brings us to Star Wars II?

Mr. MCNAMARA. Senator, I know of no group of scientific experts, and I know of no group of political or security experts inside or outside the administration, who believe we can deploy Star Wars I in the time period that is relevant to our problem, say four or five decades—none.

Therefore, the security experts and the technical experts, inside and outside the administration, who support SDI all support Star Wars II. That is to say a partial defense.

Within that group you have two divisions. You have the group that will support what I will call Star Wars II–A, limited to hard-point defense.

You have the group that will support Star Wars II–B, which is hard-point defense plus a partial population defense.

Those are two quite different systems. For the minute, I merge them together under the term Star Wars II. The reason I merge them together is that all of these partial systems, all of the leaky systems, carry with them the requirement that there be an arms control agreement that limits offense and permits defense. As I have said, I believe that is impossible. Therefore, all of those Star Wars systems carry with them the almost certain likelihood that there will be an escalation in the arms race beyond anything we can conceive of. And there will be tremendous costs financially and politically.

Let me say this is not a partisan problem. There are Democrats and Republicans on both sides of this issue. But all supporters of Star Wars II have as their primary objective strengthening deterrence. They all fear the Soviet first-strike capability.

I think that is a misperception. But it is a reality and we must deal with it. The way to deal with it is the way Scowcroft proposed, Schlesinger proposed, and Brown proposed, and that is by negotiating a reduction in the Soviet capability to attack our land-based force.

I have a strong feeling that today is the day to do it. I think this country is strong. I think the President has a strong bargaining position and I believe that can be done.

TREATY BARGAINING POSITION

Senator CHILES. And it is the threat of Star Wars II that gives you additional leverage that you could negotiate.

Mr. McNAMARA. Even without it, I think it could be negotiated. However, I support continuation of Star Wars research. I think this is a necessary insurance policy if we do it right and in the proper amount.

Senator STEVENS. Senator Sasser.

Senator SASSER. Thank you, Mr. Chairman.

Mr. Secretary, I want to add my congratulations to those that have come before. I think it is important that you continue to speak out on these issues and become part of the national dialog on this whole very crucial and critical question. I want to commend you for doing so and urge you to continue to do so in the future.

I think what you have to say is critically important to all of us, whether we happen to agree with you or not, and, quite frankly, I find myself in large agreement with what you have had to say today and previously.

SOVIET CAPABILITY IN STRATEGIC DEFENSE AREA

Having said that, Mr. McNamara, could you give us an assessment of Soviet capability in the strategic defense area from your standpoint?

We are bombarded with statements that say we must go forward with this, the Soviets are working on this very diligently, they are ahead of us in certain areas, that we have no alternative but to go forward.

You partially addressed this, I think, in your previous answers, but I want to get this clearly on the record and see what your views are with regard to Soviet capability and ask you also if you see any likelihood that the Soviets would want a breakout of the ABM Treaty?

Mr. McNAMARA. On the latter point, do the Soviets wish a breakout of the treaty, I think they are very much opposed to moving away from the ABM Treaty. I see absolutely no evidence that they are preparing to break out from that treaty.

I see considerable indications they are fearful that we will. As I said, they are beginning to prepare themselves for such an eventuality, as, frankly, we would if we were facing them.

Secretary Weinberger has often said that over the last 15 years, the Soviets have spent roughly as much on strategic defensive systems as on their enormously expensive offensive systems. From that has been drawn the conclusion they are ahead of us and we are in an inferior position.

The Secretary's statement is true, but it is not correct to draw the conclusion that we are in an inferior position. By far the greatest portion of that Soviet investment in strategic defense has been in bomber defenses. The United States stopped maintaining bomber defenses in the mid-1960's as the threat became primarily missile oriented.

The missiles could take out our bomber defense. Why should we continue with it? We stopped it. It was wise. We have saved tens of billions since that time. The Soviets have continued to spend. Their air defense system is, in a sense, a pile of junk. From my point of view, I am delighted they wasted those resources.

Lest you think my statement is incorrect and without foundation, let me repeat to you that the Joint Chiefs of Staff support that statement. When asked if they would trade forces with the Soviets' offensive and defensive forces, they had made it clear they would not.

Gen. David Jones, Chairman of the Joint Chiefs, said in 1980, "I would not swap our present military capability with that of the Soviets."

His view was confirmed by General Vessey, Chairman from 1982 to 1985. He said, "Overall, would I trade with Marshal Ogorkov, Chief of Staff of the Soviet Armed Forces? Not on your life, I would not trade."

The current U.S. Chairman, Admiral Crowe, has said essentially the same thing. The national intelligence estimates have also supported that contention.

No expert in the U.S. Government that I am aware of believes that our bombers and our missiles could not penetrate the Soviet defenses today and none I know of believes they would not be able to penetrate tomorrow or in the foreseeable future.

PENETRABILITY OF SOVIET NUCLEAR WARHEADS

Senator SASSER. One final question. It appears that clearly the offense holds the advantage over the defense with regard to strategic nuclear weapons.

Even if the SDI should work flawlessly, even if we could deploy it, even if we could afford it, still the experts say that there would be a minimum leakage of about 10 percent of incoming ICBM warheads and that would amount to in the neighborhood of at least 1,000 warheads, perhaps well over that.

So, given that scenario, clearly the offense is going to continue to hold the advantage over the defense in the foreseeable future, that is, even if the SDI should be deployed and even if it should work.

I assume you would agree with that?

Mr. McNAMARA. Yes; I think this points to a major issue which Paul Nitze noted in setting one of the three criteria that must be met prior to a decision to deploy Star Wars II. He phrased it as the system must be "cost effective at the margin."

He simply meant that we must be able to add a unit of defense more cheaply than our opponent can add a unit of offense. I doubt very much that that criteria can ever be met.

Senator SASSER. Let me move on to the real crux of my questions.

DEFENSIVE SYSTEMS ESCALATING ARMS RACE

Do you see any scenario in which a defensive system could play a role in bringing about a stabilization in the arms race or are these defensive systems simply going to be accelerated?

Mr. MCNAMARA. The defensive systems, if deployed or if they appear likely to be deployed, will definitely lead to an escalation of the arms race. I say that without qualification.

Senator STEVENS. Senator Cochran.

Senator COCHRAN. Thank you, Mr. Chairman.

Mr. Secretary, one part of this discussion bothers me and that is the assumption that seems to be made that if we continue to comply with the ABM Treaty, as written, that there is going to be a slowdown in the buildup on the Soviet side or they are going to refrain from doing things that they have been doing for the past 20 years under the treaty to escalate and build up their offensive capability to the point where we are confronted with a very difficult choice.

Do we continue to try to keep abreast of them or do we try to find an alternative to that?

We are, of course, wanting to negotiate an agreement that would reduce the number of warheads targeted to the United States, as you suggest, as the best solution. I agree that is the best solution, but there has been no encouragement whatsoever that we can succeed in that.

So, do we then just sit back on our hands and assume the Soviets are going to have our safety and security in mind as they continue to develop and do research in space with weapon systems, with all kinds of new technologies, which we know they are doing, and assume that it is going to serve our interest and our good intention by complying with ABM? Will being nice fellows be in the best interest of our Nation's citizens?

I think that is really the question we are trying to confront now. You appear to be trying to convince this committee that we should not go forward with any research in the new technology, and we should not try to find out what the Soviets are capable of doing with the things they are developing.

I worry about that, frankly.

Mr. MCNAMARA. Senator, perhaps I spoke on this point before you came in.

Senator COCHRAN. I read your statement.

MAINTAINING RESEARCH ON SDI

Mr. MCNAMARA. But I answered some questions. Let me repeat unequivocally, and I want this underlined in the record, I have never suggested, I do not suggest today, I will not suggest tomorrow, termination of the SDI research program.

Second, I would never suggest that we assume with respect to the Soviets that they are good boys, or that they are acting in our interest. I would suggest we assume only that they will act in their own interest.

Third, I would never suggest we enter into an agreement with them that we cannot verify unilaterally.

Fourth, I want to suggest to you that the growth of the Soviet forces in the last 25 years, the growth of the Soviets' strategic warhead forces in the last 25 years has been largely a reaction to the growth in our forces in which I had a large part to play and for which I must assume considerable responsibility.

Mr. Chairman, over the weekend I was writing two or three pages on this subject which I would like to insert in the record.

Senator STEVENS. We will include it in the record.

[The information follows:]

COMMENTS OF ROBERT MCNAMARA ON THE BUILD-UP OF SOVIET STRATEGIC FORCES

Many Americans are under the impression that while the United States expands its nuclear forces at some times, and shows restraint at others, the Soviet Union pursues a relentless, inexorable build-up.

President Reagan, for example, has said:

> "We've tried time and time again to set an example by cutting our own forces in the hope that the Soviets would do likewise. The result has always been that they keep building.

From this it is argued the United States must continue to expand merely to catch up.

The reality of the matter is much more complex than such misperceptions suggest. Soviet decisions about the forces that they will build are not simply the result of an internally-motivated drive for power and superiority. Many, if not most, of their force increases over the past twenty years can best be understood as reactions to American developments. In reverse, the same applies to many American developments. I have referred to this as the "action-reaction phenomenon". It is a fundamental force driving the nuclear arms race.

I do not mean to suggest that Soviet weapons programs can be explained as nothing more than direct reactions to US programs. Clearly, they have pursued different paths, sought to exploit their own strengths, followed their own strategic thought, and dealth with distinct domestic pressures. Nonetheless, they have been strongly influenced by US decisions and directions, in the same way as their decisions have influenced us. The action-reaction phenomenon has contributed to the situation we face today. By understanding it we can limit its influence in the future. The following examples illustrate how it operates.

While serving as Secretary, I was repeatedly forced to make decisions about the forces we would begin to build today to balance Soviet forces that we believed might exist tomorrow. Such decisions were speculative, based on incomplete, often contradictory, and constantly-changing information.

The production lead time on our force level increases was perhaps five years. While weapons development decisions often did not translate into operational forces in less than ten years. Therefore, when making production or development decisions, we were forced to "guess" what Soviet forces would look like 5 or 10 years in the future. We had a limited knowledge of Soviet capabilities to develop and produce missiles and bombers -- we had no information on how they intended to use those capabilities. As a result we leaned toward "worst case" assumptions. We assumed, in other words, the Soviets would maximize the use of their resources.

How did this affect the arms race?

The table below shows the results of thirty five years of "action and reaction".

Growth of US and Soviet Strategic Nuclear Warheads

	1950	1955	1960	1965	1970	1975	1980	1985
US								
Missile Warheads			68	1050	1800	6100	7300	8000
Bombs	450	4750	6000	4500	2200	2400	2800	3000
Total	450	4750	6068	5550	4000	8500	10,100	11000
Soviet								
Missile Warheads			some	225	1600	2500	5500	9500
Bombs		20	300	375	200	300	500	750
Total		20	300	600	1800	2800	6000	10250

In 1960 and 1961, the US had 68 missiles. The Soviets had a lesser number . We assumed they would build up rapidly. We, therefore, ordered several hundred Minutemen and Polaris missiles for delivery by 1965. We misjudged Soviet intentions. In 1965, therefore, our missiles force carried 1,050 warheads compared to their 225. Between 1965 and 1970, we added only 750 warheads, the Soviets 1,375, nearly twice as many. But they were simply trying to catch up. They didn't make it. In 1970, our missile force carried 1,800 warheads; theirs 1,600.

Perhaps the most dramatic example of the action-reaction phenomenon is the development and introduction of MIRV's (multiple independent reentry vehicles). These are individual warheads which can be aimed at different targets but which can be clustered together and carried aloft in bunches of 3, or 10, or even more, by one missile launcher. MIRV's were introduced into both the US and Soviet forces in the 1970's. Their development led to a quadrupling of the number of missile warheads -- a truly explosive development in the arms race.

How did this come about?

In the mid-1960's, we had irrefutable evidence that the Soviets were deploying an anti-ballistic missile (ABM) system around Moscow -- a system to defend their capital against our long-range missiles. We made the reasonable -- but perhaps incorrect assumption -- that they would deploy the system across the entire Soviet Union. Why would anyone put a system around one city and nowhere else? Were a nationwide Soviet ABM system to be put in place, it would require that we make major changes in our force levels..

The Congress believed that the proper response was for the US to deploy its own countrywide ABM system. The Army had been working on such systems since the late 1950s, first the Nike-Zeus and later the Nike-X. In 1966, therefore, the Congress authorized and appropriated funds for production of a Nike system. President Johnson and I believed the system would provide little, if any, protection to either our population or to our weapons. We refused to spend the funds which Congress had appropriated. Instead, we sought to negotiate an agreement with the Soviets which would prohibit the different offensive forces and limit strategic offensive forces.

In June 1967, the Soviet Premier, Aleksi Kosygin, came to New York to visit the United Nations. After some difficulty, it was arranged for the Premier and President Johnson to meet on June at Glassboro, New Jersey -- Glassboro is half-way between New York and Washington -- to discuss ABM deployment. At lunch that day the President, the Prime Minister, and a group of their associates were sitting around a small oval table. It was clear the President was becoming frustrated by Kosygin's failure to see the US point of view on ABM defenses. Finally, the President turned to me and asked me to explain our position.

I said, "Mr. Prime Minister, you must understand that the proper US response to your Soviet ABM system is an expansion of our offensive force. If we had the right number of offensive weapons to maintain a deterrent before you put your defenses in, then to maintain the same degree of deterrence, in the face of your defense, we must strengthen our offense. Deployment of a Soviet ABM system will lead to an escalation of the arms race. That's not good for either one of us."

Kosygin was furious. The blood rushed to his face: he pounded on the table; and he said: "Defense is moral; offense is immoral!" That was essentially the end of the discussion. The Soviet Union was by no means ready at that time to discuss an agreement banning defensive systems.

Following our return to Washington, there was unanimous agreement among the Chiefs, the President and me that we must initiate action to expand our offensive forces. The cheapest way to do that was to develop MIRVs. By placing more than one warhead on each missile, the US could increase the number of warheads far more cheaply than by building more missiles. But we recognized this was a very dangerous step -- if the Soviets followed our lead, as we must assume they would, it would lead to a dramatic increase in the offensive forces of each side. We, therefore, concluded that we would proceed with the development of MIRV's, but we would make no decision to deploy them until we had explored fully the possibilities of negotiating an agreement to prohibit defenses. If such a treaty would be negotiated, the MIRV program would be scrapped.

When I left office in February, 1968, the Soviets were still moving ahead with the ABM system and our MIRV program was acquiring a strong constituency in this country. What followed is a matter of record. The US and the USSR did agree on an ABM Treaty in 1972, but it was decided, nonetheless, to proceed with deployment of MIRV's. US missile warheads increased from 1,800 in 1970 to 6,100 in 1975 -- the Soviets, who were behind us in the development of MIRV technology expanded their warheads by only 900 from 1,600 in 1970 to 2,500 in 1975.

The explosive growth in the number of Soviet missile warheads -- which is pointed to by those who say "we build, they build; we stop, they build" occurred between 1975 and 1980. During that period the Soviets more than doubled the number of their missile warheads, from 2,500 to 5,500. It was, of course, a delayed response to our MIRV decision of five years before. And it still left us in 1980 with a substantial numerical superiority: 7,300 to 5,500.

Since 1980 the Soviet build-up has continued. Today the number of warheads (missiles plus bombers) in the US and Soviet strategic forces is approximately equal: 11,000.

For thirty five years, from 1950 to 1985, the Soviets lived with numerical inferiority although, as I Have argued before, "parity" in operational terms has existed since at least October 1962.

It is essential to understand the action-reaction dynamic and to take it into account in formulating arms control and defense policies. We must learn to prepare for the bad without bringing on the worst. We must understand that every action stimulates a reaction in an endless cycle. Already the cost of our failure to do so has been the development of ridiculously large arsenals and missed opportunities to negotiate agreements to reduce them.

SDI BUDGET

Senator COCHRAN. Thank you, Mr. Secretary.

Senator STEVENS. Mr. Secretary, no question but just a comment.

The Soviets deploy their ABM system, a hundred interceptors around Moscow. They have ABM interceptors and radars at Krasnoyarsk, radar that worries us deeply. We know they have a research program. They had a better radio wave research program in 1967 and 1969 than we had when we started SDI in 1981.

I come back to the point that you and I are in agreement about the SDI research program and I respect your judgment beyond that, but I think the Congress ought to respect the judgment of the President.

We could haggle and say maybe $2.5 billion or $2 billion is enough for next year. That would mean with the argument of the President of the United States of $2.8 billion, which would be about one-quarter of 1 percent of the total budget for defense at a time when it may be important in Geneva negotiations.

I would hope that those who are articulating the cause for reducing the amount would be willing to concede at least the budget, whatever the final budget figure is, for the purpose of Geneva alone.

Mr. McNAMARA. I would have no difference of opinion with you on that, Mr. Chairman, if it were on the order of $2.5 billion.

But I want to also suggest that when the President meets next with Gorbachev, he have as a foundation for his negotiations a U.S. defense position which is strong in all its dimensions.

I very much fear that will not be the case. We are walking into the most god-awful problem in defense that I can recall in the last 25 years. There is going to be reduction in the outlays for fiscal 1987 below what the President has proposed. I am certain of that.

The question is: Will it be done in a way that will maintain our security or will it weaken our security? This has some relationship to the difference between $2.5 billion on SDI and $4.7 billion.

I maintain, and I believe the technical experts will support this, that a very strong SDI program, strong enough to serve as a strong bargaining platform and strong enough to explore all of the desirable technical avenues of opportunity can be supported at $2.5 billion.

If it is $4.7 billion, then the additional $2.2 billion is not going to come in increased taxes, it is not going to come out of social programs, it is going to come out of other defense programs. Almost surely it will come out of muscle instead of fat. That is what scares the heck out of me.

Senator STEVENS. I want to reassure you if that can be possibly avoided, we will do it.

Mr. McNAMARA. I support you in that, sir.

Senator STEVENS. It is nice to see you. We appreciate your time.

FORMER SECRETARY OF DEFENSE

STATEMENT OF HON. HAROLD BROWN, FORMER SECRETARY OF DEFENSE

INTRODUCTION OF HAROLD BROWN

Senator STEVENS. Now we want to welcome another good friend, Dr. Harold Brown, former Secretary of Defense. Many of us have worked closely with Dr. Brown.

We respect you for taking the time to come to be with us, Harold.

Mr. BROWN. I am glad to be here, Mr. Chairman.

I have not prepared a statement, Mr. Chairman, since I have already written two articles on this subject.

Senator STEVENS. I have read them.

Mr. BROWN. One was a policy analysis of the subject in a semitechnical journal, Survival, and the other was a technical analysis of the subject in Foreign Affairs, which is a policy journal.

It helps to have your audience believe you are an expert in something other than what they themselves know.

Senator STEVENS. Senator Proxmire has that in front of him.

Mr. BROWN. I can summarize my conclusions or I will be glad to take questions. Maybe I can summarize my views in 5 or 10 minutes.

OBJECTIVES OF STRATEGIC NUCLEAR POLICY

The objectives of strategic nuclear policy and programs should be, first, to reinforce deterrence, especially deterrence of nuclear war by the threat of retaliation.

Second, to increase crisis stability and arms competition stability.

Third, to deter, and one way to deter is by being prepared to respond to, Soviet breakouts in offensive or defensive nuclear forces.

Fourth, to reduce levels of strategic offensive forces, especially insofar as that helps increase stability.

And, fifth, within those limitations explore new technologies, both for offense and for defense, again with the thought of: Reinforcing deterrence; increasing stability; and if it turned out to be feasible, even to achieve damage limitation in case of a nuclear war, perhaps even to the point where the country might be able to survive or conceivably—and, of course, this is the President's dream—to make strategic offensive forces not work and, therefore, obsolete.

As you know from having read my papers, I am, to put it mildly, highly skeptical of that dream.

With those as the objectives, what are sensible criteria, first for deployment of strategic defense and, second, for saying what makes sense in terms of research and development?

DEPLOYMENT

In terms of deployment, I think the Nitze criteria are pretty much the right ones. You would have to have cost effectiveness. Exchange rates at the margin would have to be favorable; that is, you would have to be able to counter offensive forces with less than those offensive forces cost.

Second, defensive forces have to be sufficiently invulnerable to direct attack so that that is not a way of circumventing them.

Third, they should contribute to stability. That connects with their own vulnerability, of course. If they are vulnerable, they do not contribute to stability. It also correlates with the strategic offensive force ratios.

WARHEAD SURVIVABILITY

If, for example, one side had 5,000 survivable warheads—and I take fixed land-based warheads not to be survivable if they are targeted by two accurate warheads for each fixed aim point—and the other has 3,000 survivable warheads, and each has the capability to intercept successfully 4,000 warheads, that is not an equitable situation. In fact, it is not a stable situation and it is not equitable even though both sides have capability of intercepting 4,000 warheads.

The one with 5,000 will have 1,000 left and can destroy the other side. The one with 3,000 will not be able to get through the 4,000 interceptors in terms of this very simplified picture.

Second, there has to be a complementary air defense and indeed civil defense because there is not much point—some, but not much—in being able to deny ballistic missile attack, but not to be able to defend against an air-breathing attack, bombers and cruise missiles.

R&D PROGRAM

As to a research and development program, first of all, the program should help to answer the questions about the criteria for deployment. The research and development program should be aimed at telling you what the technologies are likely to be able to accomplish. There will be a lot of uncertainty because you are talking about things that are 20, 30 years beyond the present. The program should allow conclusions to be drawn as to the characteristics of such defensive systems, what would be their cost effectiveness, what would be their survivability?

The second criteria for a research and development program is that it should be compatible with the Anti-Ballistic Missile Treaty so as to avoid a breakout by the Soviet Union in terms of ground-based antiballistic missiles which they could break out into more quickly and easily than we.

They have an ongoing production base which does not violate the treaty, but does give them that capability, and also the capability for a Soviet breakout in strategic offensive forces which could increase the risk to our own retaliatory forces.

The program should preserve whatever degree of allied political support and congressional political support can be preserved and it should keep arms control available as a component of U.S. national security, which it—arms control—is, though not the be-all and end-all of national security.

Too much has been promised on behalf of arms control by its advocates and expected by the public and by the Congress. But it is a very important component of our national security.

Also, in the research and development program, it is important to reach a reasonable balance between learning more about the technology on the one hand and, on the other, keeping to a schedule that keeps in mind when a deployment of an antiballistic missile system might take place.

In particular, I have some concerns that the technology may be slighted for the benefit of spectaculars, spectaculars that claim to show great progress, that are aimed at maintaining public support, and at giving the program a momentum which may not be justified on the basis either of technology considerations, cost-effectiveness considerations, or policy considerations.

The Foreign Affairs article that I wrote, which you have before you, notes the very long term nature of any reasonable expectation of deployment.

Leaving aside the question of whether each system would be an effective system or not, the times we are talking about are 15 years at the least for the space-based kinetic energy system. I would say those really are so easily able to be countered that they do not have any effectiveness. Times of 20 to 30 years from now are likely to reach deployment of the more elaborate or more exotic space-based lasers, ground-based lasers, or x ray lasers.

I make this point in order to suggest that there is a considerable amount of time available for decision on these matters. It would be a mistake to say that we have to carry this program along so quickly that we will be able to make decisions in the early 1990's, for example.

I do not rule that out, but I am just saying you would then be making decisions in the early 1990's, 15 or 20 years before a more ambitious system could be fully deployed. You might learn something different, either in technical terms or in political terms or in international relations terms, during that interval.

I recognize that such an argument can always be used to delay programs, sensible as well as less sensible, but we ought to recognize the time scales we are dealing with.

OPERATION OF R&D PROGRAM

For efficient operation of the research and development program, I suggest that especially when you are at the several billion dollar a year level already, you are almost assuring inefficiencies and management deficiencies if you grow much faster than 25 percent a year.

If you are now at $2.7 billion—and that is not expenditures, that is obligational authority—a 25-percent increase would mean $3.25 to $3.5 billion for fiscal year 1987. That is a very rough rule of thumb. That is not a basis on which this committee or the Congress should make a decision. It is something to keep in mind as you look at the individual line items and ask questions about them.

Second, for efficient operation, the program should be oriented toward military, technical systems, and cost-effective objectives rather than toward establishing a large contractor base, whether domestically or internationally.

In terms of relations with our allies, which I think is a third important criterion for efficient operation, the United States seeks political support. It has it for research. It does not, I think, have it for full-scale development. It will not get it, I think, for deployment.

Second, some technology might be gained by transfer from the allies. I think it would be very limited in scope.

Third, the question of the antitactical ballistic missile is going to be important to the allies because they face not only a nuclear but a conventional threat from short-range ballistic missiles. They are interested in that. We are not interested in it in alliance terms. That needs to be handled properly. It has some pitfalls, big military and arms control criteria; it also has some appeal.

Finally, the search for replacement of deterrence by the threat of retaliation is understandable. Every President has sought it and I have great sympathy for this President and for the factors influencing him—some external, but some internal to any President, and I think specifically this President, who wishes to lift that threat from the world.

I have great sympathy, therefore, for the vision, but I have deep concern about the hope that the vision might somehow prove true, a hope which I think is so unlikely to be achieved as not to be a suitable basis for policy decisions. I have a deep concern that that vision will cloud people's judgment and in the end could erode public support for the deterrent nuclear strategy, deterrence by the threat of retaliation which, as the President has recently repeated, is the only one we have.

I have concern that an SDI program, even if it subsides into components and abandons the vision, will leave some pieces behind it, some of which might be helpful, but some of which could well be rather damaging.

It could leave an antitactical ballistic missile that would allow the Soviets to creep out of the Anti-Ballistic Missile Treaty by deploying antitactical ballistic missiles, which are allowed, and then just gradually increasing their range and capability in a way with which we are familiar from their other actions.

There will almost certainly be an antisatellite capability that falls out of even a very modest Strategic Defense Initiative development program, because an antisatellite is a lot easier than an antiballistic missile. That is part of the problem of the vulnerability of space-based strategic defense systems, as many of its proponents, including Professor Teller, have pointed out.

Third, hard-point defense could be a relic of the Strategic Defense Initiative program. That could, under certain circumstances, reinforce the stability of deterrence by the threat of retaliation. It could also be a slippery slope leading to abandonment of the ABM Treaty, eroding stability.

I have a somewhat different view from Secretary McNamara about at least the theoretical feasibility or desirability of such a hard-point defense. But even that will not be cost effective unless some other basing system is used than fixed hard point. Putting up a hard-point defense around Minuteman will not be cost effective. An area defense of a mobile system or a hard-point defense of a multiple protective shelter system could be cost effective.

Nevertheless, we ought, it seems to me, to explore rebasing. We ought to explore agreed reductions of the offensive threat as a way of making our land-based ICBM's more survivable. We should not say we are going to do that by hard-point defense alone, both because without rebasing, hard-point defense will not be cost effective and because hard-point defense does start you down this slippery slope that Secretary McNamara mentioned. That's particularly so if the defense is a space-based one. By the way, it is not very sensible to have a hard-point defense from space.

But if you did have a hard-point defense based in space, nobody could tell you that it was not also a population defense. If the Soviets started to do it, we would certainly behave as if it were a population defense.

I have gone on too long. These are some of my concerns. I sympathize with the vision. I think it is unattainable. I think we have to go on with research and development, first, because the Soviets do have a program. We need to protect against breakout and deter their breakout. Second, to preserve the option for hard-point defense. And third, because—who knows—I could turn out to be wrong in my technical judgment. Maybe the vision is feasible. You are more likely to find that out by an orderly research and development program than you are by an attempt to do everything all at once and right away.

Thank you, Mr. Chairman.

[The magazine articles follow:]

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The Strategic Defense Initiative: Defensive Systems and the Strategic Debate

HAROLD BROWN

The debate on defensive systems and their role in United States nuclear strategy has reappeared. In some ways this has the appearance of a revisit of the anti-ballistic missile debate of the late 1960s and very early 1970s. In fact, however, the debate is different or rather there are now two separate debates taking place, which need to be clearly and carefully distinguished. The first is whether to replace the threat of retaliation as the basis of the US nuclear deterrence strategy with a new strategy based on defence of the United States. The second is whether and to what extent the United States should deploy active defences with more limited objectives and capabilities.

The current debate is different for several reasons: some new technologies exist or are hypothesized; the ABM Treaty is in force and would have to be modified or abrogated for either side to deploy missile defences; and both the United States and the Soviet Union are moving ahead with anti-satellite systems. But the most important change is the impetus given by President Reagan, in the form of his Strategic Defense Initiative (SDI), and by the objective he has set for defensive systems. In his March 1983 speech, he expressed it as follows:

> Up until now we have increasingly based our strategy of deterrence upon the threat of retaliation. But what if free people could live secure in the knowledge that their security did not rest on the threat of instant US retaliation to deter a Soviet attack; that we could intercept and destroy strategic ballistic missiles before they reached our soil or that of our allies. I know this is a formidable task ... But is it not worth every investment necessary to free the world from the threat of nuclear war?[1]

So a consideration of the issues raised by the defensive systems cannot pick up just where we left off in the arguments of the early 1970s.

Since the advent of nuclear weapons, presidents and other American political leaders have sought an alternative to the strategy of deterrence based on the threat of massive retaliation and to a situation where the American people are vulnerable to catastrophic destruction. President Reagan is no exception. Each president, beginning with President Eisenhower, has considered the possibility of substituting defence and rejected it. At the same time, presidents have undertaken a variety of modifications to US nuclear strategy: flexible response, limited nuclear options, and the 'countervailing strategy'.

Harold Brown was US Secretary of Defense from 1977–81, and is now Chairman of the Foreign Policy Institute, SAIS, Johns Hopkins University.

This Paper is adapted from a lecture given to the California Seminar on International Security and Foreign Policy, November 1984.

Indeed, presidents and all Americans are fundamentally dissatisfied with the fact that US nuclear strategy depends on rational decisions by the Soviet Union, with the possibility that this nuclear strategy might fail, and the consequences that would follow. They are troubled by the ethical problems raised by the threat of retaliation.

One manifestation of this unease is the pastoral letter by the Catholic bishops of the US that challenges the morality of nuclear weapons as a deterrent to war. Another is represented by advocates of the freeze or of unilateral nuclear disarmament. Still another includes those who call for a war-winning strategy, or a strategy of prevailing in nuclear war.

President Reagan, too, is still asserting the value of an alternative US nuclear strategy – one based on defence – and pursuing it as a realistic programme. In the presidential debate of 21 October 1984 he said:

> MAD is mutual assured destruction, meaning if you use nuclear weapons on us the only thing we have to keep you from doing it is that we will kill as many people of yours as you will kill of ours. I think that to do everything we can to find something that would destroy weapons and not humans is a great step forward . . . .[2]

Is There an Alternative Strategy?

From my own experience, the fact of American vulnerability to utter destruction by nuclear attack erodes the confidence that political leaders have in US nuclear policy. It affects all of US national security policies and limits American military and diplomatic behaviour. I have seen this in the five presidents I have served, and in my own actions as Secretary of Defense. I have also seen the frustration that this vulnerability has created in senior US military leaders, as well as their frustration with public and Congressional criticism of efforts to modernize strategic offensive systems. Their advocacy of defensive systems, and even a defensive strategy, can thus be explained even though they may have doubts about its efficacy. I sympathize with this desire to find an alternative. But political and military leaders also have a responsibility not to deceive themselves or to mislead, however unintentionally, the American people. And their advisers have a responsibility, as difficult as that can sometimes be, to give realistic evaluations to those leaders.

If technology promised the certainty of a successful defence of the American population against strategic nuclear weapons, or even a high probability of overall success, it is likely that policy-makers and defence analysts would agree that the United States should seek that objective. There would then no doubt be a different debate, dealing with the appropriate means of moving through the transition to this new nuclear strategy, of avoiding potential problems of instability, and of managing relations with US allies and with the Soviet Union. But technology does not offer even a reasonable prospect of a successful population defence.

New Technologies and Missile Defence

A strategy of deterrence based on defence would require that the defensive systems work to near perfection, and that we have a very high level of confidence that they will do so. That is, all but a tiny percentage of the many thousands of strategic nuclear weapons would have to be destroyed before impact. The defence would have to work not only against attack by ballistic missiles but also against attacks by air-breathing systems (bombers and cruise missiles). The various defensive systems would all have to work the first time they were tried in combat. And the attacker's counter-measures would have to be negated.

Current and projected technology offers new concepts for defensive systems. Among them is the idea of a 'layered defence', specifically including space-based elements – not only for detection, tracking and discrimination but also for attack mechanisms operating as weapons in space. Defensive systems would be designed to attack ballistic missiles (or their warheads) in their boost phase, in the post-boost phase (during which re-entry vehicles are deployed), in mid-course and terminally. The concept is that several opportunities for destruction, each with a modest chance of success, would when taken together provide a high probability of interception. That is correct mathematically and technically. But such a concept requires thinking about another potential layer: the so-called 'zeroth' layer of defence – attacking land-based ballistic missiles, SSBN or bombers in the *pre-launch* phase, sometimes known as pre-emptive attack. Attacking that layer also improves the overall probability of successful defence, but the possibility that either side might adopt such a policy would have a serious effect on deterrence and strategic stability, not to mention the political relations between the super-powers.

With respect to the possible space-based components of a layered defensive system, sensors of the sort intended to acquire and track the ballistic missiles as they are launched appear to be technically feasible, although subject to counter-measures such as blinding or jamming. The accuracy required to track targets, aim laser beams or (for the more distant future) particle beams, and keep them on the target, is well beyond current component technology. The energy densities and amounts of stored energy needed for attack of missiles in the boost phase are also well beyond what has been developed or even designed. But they are not forbidden by the laws of physics. The required laser intensities, in the face of possible hardening of the ballistic missiles they are designed to attack, are perhaps a million or more times greater than anything that has been achieved to date. Other systems, using mechanisms such as X-ray lasers driven by nuclear explosions, or enormous space-based mirrors to redirect the energy from ground-based lasers can be imagined, but are not by any means yet designed.

Vulnerabilities and Counter-measures

In any case, technologies for boost-phase BMD raise a more general problem – the vulnerability of components based in space (or outside the United States) to direct attack. This applies most acutely to the more exotic systems. A typical set of orbiting laser beam weapons would probably require several hundred satellites, each carrying tens of tons of fuel. Only about 5% of the satellites would be in the right position to intercept missiles from a given launch area at any one time. Thus counter-measures aimed at direct attack of the defensive system – whether using interceptor-type anti-satellites, orbiting space mines trailing such satellites, or ground-based lasers aimed at destroying them – would have to punch only a modest hole in the defensive systems for the ballistic missiles to be able to penetrate that particular layer of defence. Moreover, because satellites are in general more fragile than ballistic missiles, a space-based system that had any chance of attacking ballistic missiles would have a much better capability to attack another system like itself. It is true that because ballistic missiles can be fired only once while satellites are in orbit continuously, the latter can be shielded with materials sent up from earth over an extended period, while a ballistic missile pays a one-time payload penalty for whatever shielding or other mechanism (such as rotation) is used to make it more difficult to destroy. The same extended period in space, however, also makes a satellite much easier to track and provides a substantially longer time to attack it.

The 'mid-course intercept layer' gives the defence system a longer period of time to make an additional attack. On the other hand, it is easier in that phase for the offence to multiply the number of objects and confuse the defence by including decoys, balloons (including balloons around both the warheads *and* the decoys) and so on. Discriminating the warheads from the decoys, in a cloud of objects, when their characteristics both overlap and vary over a wide range, is a massive sensing and information handling job, conceivable in principle but not nearly yet devised. The mid-course layer would again include many elements (such as sensors) highly susceptible to attack. And it will be more difficult for lasers or other directed energy weapons to destroy warheads than to destroy ballistic missile boosters themselves, since the warheads are already designed to withstand a very highly stressful environment during their re-entry period.

The tasks required for the terminal defence of urban-industrial areas have not changed substantially from the 1960s and 1970s. Phased-array radars and very high acceleration interceptor missiles are the critical components and they have been improved. More is now known about discriminating warheads from decoys (which is in any event technically less difficult for terminal than for mid-course defence) and additional sensors (some airborne) are available. Where interception is feasible, it can probably be done with an accuracy sufficient to allow the use of non-nuclear warheads. But the options available to the attack have also increased, e.g., manoeuvring vehicles and more sophisticated decoys.

Battle Management

Battle management of all the data and of the sequence of defence actions required in such a layered system will pose an enormous challenge to information processing capability. It probably would be feasible in terms of hardware, but poses a completely new order of complexity in software. The battle management system would also require a very fast response time – for intercept in the boost phase, two or three minutes. That requires automatic responses. There would be no time for human judgment in real time, although human judgment could be fed into the pre-programmed series of automatic responses.

Most of the ideas for defensive systems from space involve non-nuclear weapons to intercept the nuclear weapons being defended against. Thus, activation of the system by mistake (so that it fires for example at a few test missiles launched by the other side, or fires at the other side's defensive system, or even fires at itself, which could well happen) would not necessarily provoke a nuclear war. But it certainly could create a serious crisis.

A Net Assessment

In summary, new concepts and ABM technologies have appeared since the 1970s. But the same problem remains: both the United States and the Soviet Union will be able to undertake successful counter-measures against any system intended to defend urban-industrial centres and their populations – however many the layers of defence. They can do any number of things to counter missile defences: hardening the missiles, decoys, balloons, employing precursor explosions. They could complete the boost phase at a lower altitude to make the missile launch more difficult to detect from space. They could employ tactics of concentrating forces to saturate and overwhelm the defence, or to punch holes in the defence. They could also undertake efforts to attack the defensive systems directly. The space segment of the defence system in particular (sensors and satellites) is more vulnerable than the ballistic missiles it is designed to attack, and only one geographical or functional segment need be destroyed to breach this part of the system. And the United States and the Soviet Union could both always increase the number of their offensive forces.

The addition of the layers, especially space-based layers, other than the terminal one is the technical essence of the Strategic Defense Initiative that the Reagan Administration has put forward. SDI proponents claim that it is at least possible that this change, together with improvements in each layer, will cause a shift in the offence/defence cost-exchange ratio (the ratio between the amount that the offence has to spend to offset the effect of the defence, and the cost of that defence) for a constant level of damage. But none of the proposed new layers of the SDI have been elaborated to the point where any significant calculations can be made to support such a claim. So far, the evidence is all to the contrary, even though the new basing schemes, to give offensive forces greater survivability, would substantially increase their cost. The cost-exchange ratio for active defence of urban areas, even with only, say 50% of structures surviving in major urban centres, still seems to favour the offence by five or ten to one.

Finally, with respect to protection of populations against a missile attack, a super-power determined to penetrate defences with a retaliatory strike (even after its own forces may have been severely damaged in a pre-emptive strike) will be able to do so, by a combination of counter-measures including an increase in its own strategic offensive forces.

Bomber Defence and Civil Defence

As noted, a shift in strategy to one of defence of population would also require a system of active defences against air-breathing weapons, bombers and cruise missiles. That kind of defence is now unconstrained on both sides, not limited by treaty in any direct way, except as it also provides anti-ballistic missile capability.

Successful defence of urban-industrial targets against a nuclear attack by bombers and cruise missiles is also not feasible. The reasons are the same as or analogous to those for the outcome of defence/offence competition in ballistic missiles. In strategic terms, these are the enormous destructive power of a single nuclear weapon, and the difficulty and cost of intercepting nearly 100% of the weapons aimed at the many targets to be defended. In tactical terms, the reasons are the offence's ability to saturate defences; to use attack corridors, electronic and other counter-measures; to employ low observable designs, decoys and varied flight profiles; and to attack directly the vulnerable elements of the system. Despite the enormous effort expended by the Soviet Union over past decades on sophisticated air defences, the US air-breathing force can still penetrate these air defences.

Civil defence (fallout shelters and/or evacuation) will in general be a more cost-effective way of reducing population casualties than will active missile or bomber defence. The American public has not, however, been willing to accept the changes in life-style, including practice exercises, that a massive civil defence programme would require. The response might be different if civil defence *added* to SDI could lower casualties from tens of millions of deaths to a few million. But SDI will not reduce them even to a few tens of millions. Civil defence fallout shelters protect principally from fallout, rather than from the blast or fires. And while evacuation can distance populations from the prompt effects, the attacker can always adjust his attack so that a significant reduction in casualties could probably not be achieved.

Managing the Deterrent Strategy

In sum, the combinations of limitations – scientific, technological, systems engineering, cost – and especially the potential counter-measures make the prospect of a perfect or near perfect defence negligibly low. An alternative defensive strategy is, therefore, not feasible, and the United States must continue to maintain her security, first of all by managing a deterrent strategy which relies on offensive strategic nuclear forces and the threat of retaliation. Such a strategy is not, as some would suggest, one that threatens to destroy Soviet citizens *per se*. It is rather a strategy that puts at risk all the things the Soviet leaders value – their military forces, their economic and industrial base and, under some circumstances, the political leadership itself. Second, the United States must continue to manage a Soviet–American political and military relationship which, for very fundamental reasons, will continue to be competitive and adversarial through our lifetimes and beyond. But the US must also find ways to avoid conflict and handle crises, while asserting and preserving vital US interests; and to the extent possible the US should seek an evolution in the overall Soviet–American relationship.

Even more serious than a fruitless pursuit of an infeasible alternative nuclear strategy would be for the SDI, and the debate on active defence, so to distract the United States that she fails in either of these two tasks: reinforcing the deterrent, and managing the Soviet–American competition. Political leaders, above all, have a responsibility to ensure the stability that current American strategy provides. This is so, however difficult the task and however precarious the stability may be. The expert judgment, which this author shares, is that the stability of deterrence is less precarious than the public thinks it is. But political leaders must manage the present competition to avoid nuclear war and work to reduce its future political, military and technical risks.

To summarize, political leaders need to confront the issue of whether to abandon the strategy of deterrence based on the threat of retaliation, for a strategy of protecting the American people from attack by ballistic missiles and by air-breathing systems. And the experts should not ignore the fact that it is the prospect of replacing the present strategy with a radically new one that attracts the attention of Presidents, Secretaries of State and Secretaries of Defense.

The Expert Debate: Are Limited Objectives Feasible and Desirable

Given developments both in technology and in the state of the Soviet–American nuclear balance, the United States needs to address the separate issue of whether defensive systems might serve either or both of two other more limited but important objectives: to enhance deterrence by ensuring the US strategic retaliatory capability; and to reduce the damage to the United States if deterrence should fail. Whether defensive systems should be introduced and the ABM Treaty modified or abrogated for either of these reasons will depend on different technical and policy considerations. And a final judgment should turn on whether defences would reinforce the strategy of deterrence based on the threat of retaliation.

Ensuring Retaliatory Capability

In the past, the United States has attempted to ensure her ability to retaliate by having a diverse triad of strategic nuclear forces, by moving towards more survivable basing modes, and by seeking limits on Soviet offensive forces. Would an ABM defence be effective – and is it also necessary – as an additional step to protect US retaliatory capabilities in the future? Proponents of the SDI suggest that an ABM system could enhance deterrence by improving the survivability of US strategic nuclear forces – or, put another way, that an ABM would increase the uncertainty in the adversary's mind about the potential success of a pre-emptive strike.

The task of defending nuclear forces is much easier than defending the American population. The targets to be defended are generally fixed points, or limited areas. Except for aircraft, they are much 'harder' – that is, more resistant to nuclear explosions. The degree of success required is far less than perfection, and the defence can tolerate significant levels of uncertainty; e.g., if 25% of the ICBM force were saved by active defence, the defensive system would be a success. On the other hand, the offence needs a high degree of certainty of destruction of such targets, because it is attempting to prevent retaliation.

Offence counter-measures will be possible in this case also, but at least for certain kinds of offensive forces and basing schemes a defence system can have a favourable cost-exchange ratio. That will tend to be so, for example, for ICBM in a deceptive basing mode using hardened silos, defended by a terminal ABM system based the same way. It may also be so for hardened mobile ICBM, protected by an ABM overlay based in similar vehicles. For fixed silo-based missiles, however, the cost-exchange ratio for a defence overlay will be less favourable by a factor of two or three – and may thus be unattractive. Strategic command, control and communications centres will also profit less than ICBM from ABM defence, because their relatively small numbers would allow the offence to target many warheads on each. Alert bombers are soft and their bases small in number. They are best preserved by launching them under positive control upon early tactical warning. Embarked submarines are not suitable for defence by ABM; they are best preserved from attack by the inability of the offence to locate them.

An ABM defence with this more limited purpose of defending land-based missiles could be accomplished through a terminal defence and is feasible with known technology. Space-based weapons would probably not be cost effective as part of such an ABM system, though space-based sensors could be.

Should the United States move to modify or abrogate the ABM Treaty to ensure her retaliatory capability? If so, under what conditions? The answer will depend on several factors: first, what the Soviet Union does in terms of offensive weapons to keep up her pace of modernization in response to any US SDI; second, what the US is able to do to enhance the survivability of her ICBM through mobility, deceptive basing, etc.; and third, what possibilities exist for arms control, and specifically limits on offensive forces and new types of missiles. A decision on ABM defence of retaliatory forces should be based on a judgment as to the retaliatory capability required of, and available in, US strategic nuclear forces – not on the general desirability of introducing more survivability in US forces or creating more uncertainty in the calculations of an attacker.

Under certain circumstances, ABM defence could become critical to maintaining the retaliatory capability of US strategic nuclear forces, or at least a particular leg of the triad – that is, the land-based ICBM. But at what point such a deployment might be required is uncertain. It would depend on how many legs of the triad were prospectively at risk and the seriousness of the threat – posed, for example, by highly accurate re-entry vehicles in large numbers in the case of SLBM and/or by barrage attacks on bombers soon after their take-off. If such a threshold were reached and a threat to the overall US retaliatory capability were perceived to impend, then the US should pursue active defence; if necessary, she should seek to modify the ABM Treaty to permit a terminal defence of nuclear forces, despite the risk that such a defence would be a step in the direction of population defence. But such a threat to the US retaliatory capability does not exist today and is not likely to arise during this century if the US pursues a strategic modernization programme, generally along the lines of current plans, that includes all legs of the triad. So there is no need now to pursue deployment of defensive systems to ensure US retaliatory capability.

Hedging Against the Failure of Deterrence

As a second limited objective, the United States could pursue defence as a hedge against the possibility that deterrence might fail. Such a failure could occur in the form of a war between the super-powers, an attack by a third country, or an accidental or unauthorized launch. If the failure resulted in the use of thousands of weapons, an imperfect defence could not significantly reduce the damage. Moreover, counter-measures to the deployment of such a defence could be designed by an attacker (including force increases) to restore fully the same level of damage planned in the absence of defences.

Whether casualties could be reduced in the case of small attacks would depend on the nature of both the attack and of the defence, and is a more complicated question. If regional powers (e.g., India, Pakistan, Israel, South Africa) can build a few nuclear weapons they will, if they did so, probably be driven by the motive of influencing the behaviour of their neighbours and would not be a direct threat to the US. Groups or nations could, however, potentially threaten the United States with nuclear weapons as an instrument of terrorism. But in these cases, the threat against the US would be, at least in the near-term, through delivery of nuclear weapons by surreptitious means or low-flying aircraft, not by ballistic missiles. So an ABM defence would not help.

An accidental, unauthorized or demonstration attack of a few to a few dozen missiles from the Soviet Union could be very sophisticated, involve up to hundreds of warheads, and be aimed at targets of any kind anywhere in the United States. To defend successfully against such limited attacks an ABM would, therefore, have to cover the major urban areas. Such a defence (and its Soviet counterpart) would therefore provide a substantial base for breaking out of any ABM limitations. The gravest of such threats would be a small attack on the American political centre, Washington. The Soviet Union has correspondingly deployed around Moscow the limited ABM allowed by the ABM Treaty. Various presidents of the United States have concluded on several occasions that a defence of Washington without a nation-wide defence is not politically feasible.

A limited space-based system, automatically covering the entire country, may seem ideal for defence against small attacks. An alternative would be a relatively thin nation-wide terminal defence similar to that proposed by President Johnson in 1967. Both would probably be needed to cope with a small attack that could strike anywhere in the United States. A defence against a small bomber/cruise missile attack would also be necessary. In short, the defensive system – though limited in comparison to full-scale defence – would still be substantial and extensive; hence the cost, though smaller, would be comparable as well. Moreover, if a small ballistic-missile attack were sophisticated and concentrated on a single target area, then a limited defensive system could probably be saturated and penetrated. Thus, to hedge, for all cases of small attacks, against the possibility that deterrence may fail, the United States would need to deploy a defence system approaching an all-out ABM deployment.

Risks and Costs

To pursue the objective of hedging against the failure of deterrence would introduce major risks and costs. The risks are those articulated by ABM opponents since the 1960s, and are most salient for the case of an all-out ABM deployment by both sides. More limited defences would inherently produce similar risks (though of lesser intensity).

First, in terms of the arms competition any US ABM defence would prompt Soviet counter-measures – certainly an increase in offensive missiles but probably also in other kinds of nuclear forces as well (e.g., bombers and cruise missiles) – to compensate. If the USSR were to respond with her own defensive systems, the US would have to take her own counter-measures in terms of offensive forces. As a result, the arms competition – offensive and defensive – would be accelerated, and neither side would have much interest in arms-control limits on offensive systems.

With or without constraints on the build-up of offensive forces, defensive systems would create uncertainties as to the effectiveness of the retaliatory capabilities on each side. This could lead to pressures to pre-empt with nuclear weapons in a crisis. While it is most unlikely that either side could confidently believe that it had a first strike damage-limiting capability, any such possibility could prove enormously destabilizing. And new kinds of pressures could arise: to pre-empt with anti-satellites against the space-based defensive system, conceivably as it was being deployed, or more likely in a crisis; to pre-empt with nuclear weapons against the offensive forces of the other side to gain greater confidence in the performance of one's own defensive system.

The financial costs are an additional problem. The costs of ABM, air defence and civil defence to replace the deterrent strategy could approach a trillion dollars. Deployment costs for ABM defence of ICBM would be $10 billion or more; defences for damage limitation within a deterrent strategy could cost upwards of $100 billion. Expenditures of this magnitude would reduce funds potentially available for strategic offensive nuclear forces and for conventional forces. And this problem of cost might not be symmetrical between the US and the USSR: the USSR can less afford the resource costs, but Soviet leaders are more capable of exercising the political discipline necessary to exact such sacrifices.

An extension of strategic defence to cover US allies from an all-out Soviet nuclear attack on their populations and industry raises additional problems of feasibility and cost. Defence of the US territory only, or even a world-wide defence operated by the US, could raise Allied concerns about the continued US commitment to the defence of Europe. And if the super-powers' nuclear forces were neutralized, the Allies could become concerned that they were thereby more vulnerable to conventional attack. Finally, if the Soviet Union were to pursue an expanded programme of active missile defence, the British and French would have additional concerns about the continued viability of their independent nuclear deterrent. (Soviet and perhaps US ABM deployment could also be a problem for the Chinese.)

In summary, an imperfect defence could not be expected to reduce significantly the damage to the United States if deterrence failed through a deliberate and major attack. To protect the United States against even a small missile attack, the US would still need to deploy a substantial and extensive ABM system. And the risks of deploying such a system outweigh its potential for saving some American lives. There are therefore strong reasons to oppose moving to abrogate or modify the ABM Treaty, despite the new technical developments and the hope that there may be further ones.

Arms Control

This consideration of the issues connected with defensive systems illustrates the importance of arms control to the United States in the future. US strategic requirements are not jeopardized by maintaining the ABM Treaty; to the contrary, US interests are served by continued adherence to that treaty. If the Soviet Union began to deploy missile defences beyond her present Moscow system, the United States would have to undertake counter-measures involving offensive and probably also defensive forces, with all the potential risks and costs outlined above.

The United States should be able to avoid having to deploy defences to ensure her retaliatory capability – including by rebasing ICBM as necessary – providing that she can achieve appropriate restraints on Soviet offensive forces. Such constraints, especially if they involved reductions in missile warheads and limits on new types of missiles, would also promote stability and thereby reduce the chances that deterrence would fail.[3] At least theoretically, sufficiently drastic and verifiable reductions in offensive forces could open up the possibility of a near-perfect defence. Arms control, in other words, could provide the means to achieve the same objectives sought by proponents of SDI.

As to negotiating leverage, it is not clear what SDI might provide. The Soviet leaders in their public statements have expressed concern about SDI and called for a demilitarization of space. But it does not follow that they would give up anything beyond their own SDI in return. In INF negotiations, they were not willing to give up all their own SS-20s in return for non-deployment of the US *Pershing* II and ground-launched cruise missiles about which they had expressed so much concern, although they did indicate that they were prepared to freeze or even reduce current SS-20 levels.

The argument that actual deployment of US defences – at a level short of perfection – would provide leverage to gain significant reductions in Soviet missile forces seems to fail on logic as well as on common sense. US deployments of MIRV may have produced the ABM Treaty by convincing the Soviet Union of the futility of ABM, but it is difficult to see how American ABM will produce constraints on Soviet MIRV. The opposite effect – an increase in Soviet MIRV – seems far more likely. Moreover, constraints on offence with unlimited defences would be most destabilizing.

If the United States seeks to reduce the Soviet ICBM threat, US offensive forces may provide more appropriate bargaining material. But for that to be credible, the United States would have to be prepared to trade away the MX, nuclear sea-launched cruise missiles, or other new systems for comparable Soviet reductions. In the end, it is likely that future strategic arms agreements will be negotiated taking into account offensive and defensive arms at the same time.

Research and Development

As to future research and development (R&D) on ABM defence, the United States should, within the limits of the ABM Treaty, continue a major effort for the same reasons as in the past.

First, technology might conceivably be developed in the future that *would* provide an alternative strategy based on defence. While the chances are very low, the United States should not ignore that possibility completely, for deterrence based on the threat of nuclear retaliation will never be a comfortable strategy.

Second, an R&D programme keeps open the option of ABM deployment to defend nuclear forces only to preserve the retaliatory capability.

Third, the United States needs to be able to threaten a response in kind if the USSR should break out of the ABM Treaty, even though a defence will probably not be the best or most important response.

An R&D programme corresponding to these purposes could suitably grow by the end of the decade to double its level of 1.5 billion for Fiscal Year 1985. But the effort should emphasize the development, testing and demonstration of components for ground-based terminal defence, plus sensors for early warning and assessment of attack, that would be based wherever they are most cost-effective. The current R&D programme has been distorted by the inclusion of related but different activities in a common budget, and funding for some of the most important parts may be jeopardized by redirection towards the objective of nation-wide defence.

The ABM Treaty prohibits the parties from developing, testing, or deploying ABM systems or components which are sea-based, air-based, space-based or mobile land-based. The US ABM research and development programme should be carried out within those limits. Because 'components' are not well defined for systems that have not been designed, careful consideration will be needed in formulating any R&D programme for strategic defence that involves space-based components.

Recommendations

In light of the above, as President Reagan defines his policies and programmes for strategic defence:

First, the President should reaffirm the current US nuclear strategy and back away from his objective of trying to substitute defence of the American population for deterrence by the threat of retaliation. American political and military leaders should publicly acknowledge that there is no realistic prospect for a successful population defence, certainly for many decades, and probably never.

Second, the President and his advisers should make a determined effort to explain to the American public the basic elements of current US nuclear strategy, and to convince them of the need to continue to pursue peace and the prevention of nuclear war through a strategy based on the threat of retaliation. The US nuclear strategy depends for its success on gaining the confidence of the American people, however uncomfortable all may find that strategy to be.

Third, the President should pursue modernization of US strategic offensive forces to ensure the success of current US nuclear strategy.

Fourth, the United States should not plan at this point a programme to defend strategic offensive forces with BMD, but should leave open that option awaiting developments in American strategic forces, in the threats against those forces, and in arms control. To that end, the United States should continue with an extensive research, development and study programme on anti-ballistic missiles, and make the focus of the programme the defence of US retaliatory forces.

Fifth, in view of the potential risks and costs, the United States should also not now plan for a limited defence to hedge against the possibility that deterrence may fail.

Sixth, the United States should pursue a comprehensive arms control strategy. She should reaffirm her intention to preserve the ABM Treaty, and hold the USSR to the observance of that treaty. She should then pursue negotiations covering strategic offensive forces and intermediate-range forces, as well as weapons in space and anti-satellite weapons.

US goals in these negotiations ought to be: (*1*) to reduce the level of strategic offensive forces and promote the survivability of the force postures on both sides; and (*2*) to ban weapons in space while reaffirming the legitimacy of non-weapon space-based systems, such as satellites for early warning, surveillance and communications.

The United States should explore the possibility of limitations on anti-satellite deployment or a moratorium on ASAT tests, and may wish to discuss potential future modifications of the ABM Treaty, e.g., whether hard-point defence is possible without undermining the ban on nation-wide defences.

Public discussion of these matters has appropriately intensified over the past two years, but the clarity of the debate has not improved. Technical, strategic and policy analysis, much of which has already begun, should assume the centre of the stage. We need to consider realistically the factors that should inform judgments about defensive systems and strategies: the levels and kinds of offensive forces that now exist on both sides; the technologies for defence that are actually available or that could reasonably be expected to be developed in the foreseeable future; and the political and military reactions from the USSR and from US allies. The Reagan Administration's advocacy of the SDI has already changed the terms of the competition, and we should now expect a Soviet response – in counter-measures, more offensive forces, an acceleration of her own defensive programmes, or all three – even if the actual US SDI programme proceeds slowly.

The strength of the wish for a change in US strategy is understandable. But neither political leaders nor those who think about policy matters have the luxury of acting or speaking as if we were in an ideal world of perfect defences; of an arms-control regime involving reductions so deep that defence could approach perfection despite any difficulties in verification of offensive systems; or of a risk- and cost-free transition to a defence-dominated era. Avoiding nuclear war is the vital issue of our times – too vital to be clouded by wishful thinking.

NOTES

[1] Excerpts from President Reagan's 23 March 1983 speech were printed in *Survival*, May/June 1983, vol. XXV, no. 3, pp. 129-30.

[2] From United States Information Service, 'US–Soviet Relations Dominate Debate', 22 October 1984, p. 24.

[3] For an analysis of the objectives the United States should seek in negotiations with the Soviet Union on offensive nuclear forces, see H. Brown and L. Davis, 'Nuclear Arms Control: Where Do We Stand', *Survival*, July/August 1984, vol. XXVI, no. 4, pp. 146–55.

Harold Brown

IS SDI TECHNICALLY FEASIBLE?

The program known as the Strategic Defense Initiative (SDI) includes research on a variety of technologies—many aimed at distinct phases of the ballistic missile flight path. For each phase—boost, post-boost, mid-course and terminal[1]—a defense would require successful surveillance, target acquisition, tracking, guidance of the weapons, and kill mechanisms. Are the objectives of SDI technically feasible?

The answer will depend primarily on what specific objectives strategic defenses ultimately seek to achieve—protection of population, of missile silos, of other military targets. Within that context, the answer will further depend on the capabilities of the technologies and on the potential countermeasures and counter-countermeasures of each side.

This article will assess the prospects for the various defensive technologies for both the near term (10 to 15 years) and the longer term. It will include recommendations on how to proceed with a realistic research and development program. It will also make tentative judgments on the technical feasibility of various SDI objectives, though definitive answers are not yet possible. The political desirability of SDI is a separate question, not addressed here.

Finally, in considering the prospects for the various SDI technologies, it is important to remember how long it takes to move from technological development through full-scale engineering to deployment. That time is governed by the budgetary and legislative process, as well as by the state of technology.

—After the technology is proven out, full-scale engineering development of a moderately complex system will typically take five to eight years (a new ICBM is a good example).

—The course of deployment (unless there is concurrency of development with deployment, which has almost always proven counterproductive) takes five to seven years after completion of engineering development.

[1] The boost phase is the period during which the ballistic missile rockets operate to bring it to (or near) its peak velocity. In the post-boost phase the warheads (and decoys) are released from the last stage of the missile. It is followed by the mid-course phase outside of the atmosphere, the lengthiest part of the trajectory. The terminal phase is the period from shortly before reentry into the atmosphere until detonation.

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—Thus, if proven technology exists now, it will take 10 to 15 years before a new system employing the technology could be substantially deployed.

—If the technology needs to be further developed, even though the phenomena exist and are well understood, the time for that technology development will have to be added to such a period.

II

What kinds of technologies could be embodied in defenses against ballistic missiles that could begin deployment before or about the year 2000?

Terminal hard point defenses (e.g., defending ICBMs), using hardened ground-based radars and interceptor rockets, would require about ten years between a decision to deploy and having a significant force; the time to completion of deployment would approach 15 years from decision. The necessary technology exists now, and some subsystems have already been partially developed. What would be required would be the design of a new system involving—in sequence—some additional prototype development, full-scale engineering development, production and deployment. Such a system would include an interceptor like the Spartan missile aimed at reentry vehicles (RVs) outside the atmosphere, and another, rather like the Sprint missile, for intercepting RVs that have already entered the atmosphere.

Present designs of both missiles would require the use of nuclear warheads. Alternatively, non-nuclear versions could be developed using terminal homing devices in the interceptor. There is some question about how heavy a conventional warhead (and therefore the interceptor missile) would need to be in order to provide high probability of destroying the incoming RV and missile warhead; it depends on how close to the reentry vehicle the terminal guidance could bring the interceptor. If a non-nuclear interceptor is chosen, this would lengthen by at least a few years the time to a substantial deployed capability.

An additional optical sensor, the Airborne Optical Adjunct (AOA), which would track reentry vehicles by detecting their infrared emissions or viewing them with visible light, could also be included at about the same time as a non-nuclear warhead.[2] Such a capability is feasible technologically and likely to be helpful in discrimination during or shortly before the offensive missile's reentry, but the technology would need some additional development.

Over the next 10 to 15 years it also appears technologically feasible to develop the components of a system using *space-based kinetic-energy weapons*. These chemically propelled rockets would intercept the offensive missile during its boost phase and destroy the target by impact or by detonation of an exploding warhead. The chemical rockets would be similar in nature to air-to-air missiles, but steered with reaction jets rather than aerodynamic surfaces. The targets could be designated to the interceptors by laser or radar tracks, provided by a set of tracking and fire-control satellites orbiting at a higher altitude than the satellites from which the interceptors would be fired. Short-range laser designation of ground or airborne targets exists, but the accuracies required for ICBM tracking would require significant additional technological development, as would imaging and processing the infrared data, and looking close to the horizon.

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[2] Development or testing of AOA beyond the technology platform stage, as a component of an ABM system, even of a fixed ground-based ABM system, would appear to violate the ABM treaty because the AOA is itself a mobile component.

The interceptors would home onto the target, guided by their own passive observation of the infrared emissions from the target missile or by receiving reflections from the target of radar signals emitted from satellites (semiactive radar homing). Such a system, however, must find a way to direct the killer rocket to the actual ICBM booster rather than to its plume (exhaust), which emits the infrared signal. While presumably this can be done, it will add complexity and offer an opportunity for offense countermeasures. Though the technology for components of kinetic-energy kill and boost-phase intercept systems exists, solution of problems of this sort would require a considerable developmental process.

Several years of additional technical development could significantly decrease the weight of the intercept rocket for a given kill probability. That approach is indicated because the weight determines a significant part of the total system cost. The cost of putting payloads in orbit with either the present shuttle or expendable boosters is thousands of dollars per pound. To reduce those costs to an acceptable level, a new "super" shuttle would probably have to be developed. This would involve a ten-year development process and a delay in deployment of a space-based kinetic-energy system.

Missile boosters in the upper atmosphere and in space can be detected, tracked and attacked through the infrared emissions of the missiles' exhaust plumes while their propulsion stages are burning; however, the actual effectiveness of such an approach will depend not only on the technical features of the defense, but on the actions of the offense in employing decoys, adopting countermeasures and suppressing the defensive system itself. For example, modest deliberate fluctuations in booster propulsion ("jinking") could require the kinetic-energy interceptor to make significant changes in its cross-trajectory velocity, and this would involve a large weight penalty for the defense. Fast-burning boosters would effectively negate such a defense system.

Nevertheless, the technology for a space-based boost-phase intercept system of some capability, using kinetic-energy weapons, could be ready for a decision as early as 1990–92 to initiate full-scale engineering development, with a significant deployment able to begin some time between 1995 and 2000. Soon after the year 2000 there could thus be deployed a space-based kinetic-energy kill system along with a high-altitude and low-altitude terminal defense. These would constitute three layers of a possible multilayered defense, the purpose of which would be to compound modest kill probabilities in each defensive layer so as to produce a high overall kill probability.

III

For the period five to ten years beyond 1995–2000, more elaborate space- and ground-based technologies *may* be feasible, with a corresponding period of deployment beginning some time between 2000 and 2010. Increased uncertainty, however, naturally attaches the further out we look.

Among the less uncertain of these later technologies are *space-based directed-energy weapons* such as neutral particle beams and chemical lasers.

—A *neutral particle beam* (NPB) would be made up of atomic particles, accelerated to a high speed in charged form by electric fields in an accelerator, then steered and pointed by a magnet, and then neutralized so that it will not be deflected by the earth's magnetic field.

—A *chemical laser* uses the energy created by chemical reactions[3] to create a highly focused, intense, highly ordered ("coherent") beam of infrared light, directed by a mirror.

As a measure of their status, both of these technologies could well be used toward the early end of the period 2000–10 for antisatellite purposes, which are less demanding than the antiballistic missile task. Demonstrations of the capability to kill an individual satellite by such means—most likely on cooperative targets—could be made still earlier, but these would not represent an operational military system.

Neutral particle beams are, in their present state of development, much brighter than any existing laser in terms of energy into a given solid (cone) angle. Today they produce particles of energy corresponding to acceleration by a few million volts of electric field (and could in the future be improved to 100 million "electron-volt" energies). Protecting ballistic missiles from such high-energy NPBs would require much heavier shielding than would protection from lasers. During the next 10 or 15 years, however, it is unlikely that NPB technology will be able to put more than ten percent of the primary energy into the particle beam itself. Such low efficiency means that a space-based NPB would probably require a nuclear power source, development of which would delay the possible deployment of a system.

In addition to the usual target acquisition and tracking problems, a defense based on neutral particle beams has several other critical tasks. The magnet necessary to point the beam before its neutralization is likely to be heavy—and expensive—to put into space. The tasks of developing an ion source capable of operation over some minutes and of achieving the necessary pointing accuracy will be difficult. Even more difficult is tracking the beam, since it gives off almost no signal in space. Finally, the system will need to find ways to detect the effect on the target, through nuclear emanations from it, because at the full range of a successful NPB attack, the target would not be physically destroyed. Even where NPBs cannot be used to kill targets, however, they might ultimately prove useful in discriminating among them, because the nuclear emanations from an object hit by an NPB would depend on the object's weight.

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[3] For example, the chemical combination of hydrogen and fluorine. If the population of the resulting excited molecules outnumbers that of the lowest-energy ("ground") state, stimulation of emission of light of the frequency corresponding to the energy difference occurs, resulting in an intense coherent beam.

For chemical lasers several technological problems still need to be solved. One is getting high enough power while maintaining a low enough beam divergence. Another is the very large weight of chemical reactants required for providing the energy. A third is the feasibility of the large optical systems required. There are, however, some promising technologies under development for chemical and other lasers. Among them are: various phase-compensation techniques to improve the quality and stability of the beam; phase-locking separate lasers together to increase the overall brightness; using adaptive optics (rapid adjustment of segments of a mirror), both to compensate for atmospheric dispersion for ground-based lasers and to ease the problems of creating large aperture mirrors for space-based ones; and phased arrays of lasers to increase intensity and to steer them more rapidly through a small angle, so as to move quickly from target to target. But some of these technologies have yet to reach full demonstration of the physical principles involved, and all are still far from being developed.

IV

Less technologically developed, and therefore more suitable for consideration of full-scale deployment beginning 20–25 years from now, is the use of ground-based *excimer* and *free-electron lasers* (FEL)[4] to be used with mirrors in space as components of a system for boost-phase intercept. Both are now many orders of magnitude away from achieving the intensity necessary for the required lethality, the free-electron laser further away than the excimer laser, at present. But the free-electron laser's device weight is lighter and its efficiency greater (and thus, its fuel weight lighter) than that of the excimer laser. The FEL might perhaps therefore be deployable in space. But the weights of these lasers and of their energy supplies more probably would require either to be ground based. The laser wavelength for both would allow the beams to penetrate the atmosphere, if the atmospheric distortions problem is solved. Thus both seem more suitable for ground deployment along with mirrors in space. Other problems for the ground-based lasers are the large optics required, both on the ground and for the synchronous-altitude steering mirrors, and obtaining the same high power in each of a long series of repetitive pulses.

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[4] Excimer lasers use "excited" (higher-energy) states of molecules including a rare gas (e.g., argon) and a halogen (e.g., iodine). These excited states are quasi-stable, while the unexcited ("ground") states are not populated, because the rare gases are not chemically active in their lowest-energy states. Free-electron lasers use the effect of oscillating electromagnetic fields on electron beams to cause the electrons to emit phase-coherent (laser) radiation.

These two systems might also be suitable for "active" discrimination—also called "interactive" or "perturbing"—in the mid-course phase of a strategic defense. That is, they could impart energy or momentum to very large numbers of objects in mid-course being tracked by some of the more established technologies already discussed. The resulting changes in the objects being tracked, or in their trajectory, could offer some limited opportunities for discrimination of reentry vehicles from decoys and debris.

Significant technological disagreement exists about the potential of ground-based lasers (free-electron or excimer) versus space-based chemical lasers. Some believe that the smaller amount and lesser complexity of hardware required to be put in space will bring the time for availability of these ground-based lasers as close or closer than the time actually required for those entirely space-based.

Chemical lasers are more proven technologically than excimer or free-electron lasers, but many experts have dismissed their potential use because of the difficulties in designing an effective system. Chemical lasers (space-based because their wavelengths will not penetrate the atmosphere) could be of some use against ballistic missiles now deployed. They could well be severely inadequate, however, against the offensive systems (with, for example, fast-burn missiles and other countermeasures) that could be in place during the first decade of the next century, when a significant defensive laser deployment could be made. Surely such countermeasures would be put in place if defense lasers were deployed. And in light of the large weight of chemical fuel that would have to be deployed in space, the chemical laser system at present seems to fall into the category of technically feasible but ineffective as a system. New optical developments such as phased arrays and phase conjugation are now being investigated, however. These might be able to improve the brightness and stability of chemical lasers—and increase their lethal range—to the point where they would have some systems effectiveness even against a responsive threat.

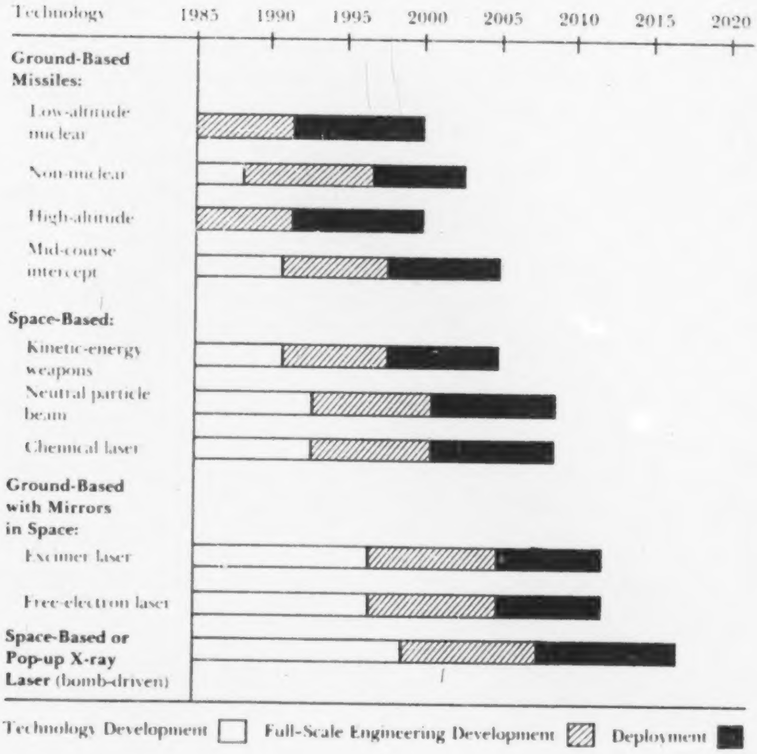
X-ray lasers powered by nuclear explosions are still further off than the other types of lasers, although they seem to offer some interesting distant possibilities. X-ray lasers would have wider beam angles and higher power per unit solid angle than optical ones. This would make them suitable for destroying clouds of objects or for actively discriminating heavy objects among them, and thus effective against such countermeasures as balloons and decoys. Proof of the most basic principle has been established, in that bomb-driven X-ray lasing has been demonstrated to be possible. But there is doubt as to what intensity has been achieved; it is in any event far less than necessary for use in active discrimination, let alone target kill. Demonstration of the physics of a possible weapon is at least five (more likely ten) years off. Weaponization would involve another five or more years, and only thereafter could its incorporation into a full-scale engineering development of a defensive system begin.

Rail guns, which accelerate objects to very high speed electromagnetically, may also have promise. But they are almost as far off as X-ray lasers. Multi-kilogram payloads would need to be accelerated to speeds above 15 kilometers per second, and a system (and power source) would need to be designed that could be used for multiple shots. New guidance and propulsion systems would also have to be engineered to survive such accelerations and to do the necessary terminal homing.

While many uncertainties exist as to future laser technologies for strategic defense, all laser systems would be vulnerable to other lasers. In general, the rules of the competition are that ground-based lasers will defeat space-based ones, larger ones will defeat smaller ones, and bomb-driven X-ray lasers looking up though the fringes of the atmosphere will defeat the same sort of X-ray lasers looking down into the fringes of the atmosphere. Vulnerabilities will also differ as between ground-based and space-based lasers. The former would have the weapons—or at least their energy source—on the ground, and presumably would include mirrors stored or unfolded in or popped up into space for the purpose of steering the laser beams.

As to time scale, when one is talking about time scales for deployment 25 or more years from now, corresponding to technologies whose full demonstration is more than ten years away, one really cannot know what the time scale will be to reach substantial deployment. The accompanying chart summarizes the time scales for these various systems. For the space-based systems, the pop-up systems and those with mirrors in space, lengthy technology development periods will be required. Depending on how that development is carried out, it may be possible to defer collision with the provisions of the ABM treaty until early in the process of full-scale engineering development. The calendar times differ for each technology, as shown in Figure 1:

FIGURE 1



V

A successful strategic defense would require not only kill mechanics but also a *battle management system* involving sophisticated *command, control and communications* (C^3). Estimates for the total number of lines of code of software required range from 10 million to 100 million. A measure of the effort involved can be derived by using the standard figure of $50 a line. Thus, the software costs could range from $500 million to $5 billion. The raw cost of such a system is therefore less important than the feasibility and methods of finding and correcting errors in it.

One problem would be with errors in the codes themselves. While this would not be trivial, it could be dealt with in part through automated software production and through artificial intelligence. The latter, though still mostly in the conceptual stage, nevertheless has real capabilities in terms of expert systems, and can be expected to produce real advances within the next ten years. The most fundamental problems for battle management and C^3 are: the establishment of appropriate rules of engagement; the probability of conceptual as well as mechanical error in the creation of the software, and the possibility of redundancy to compensate for it; the need to change portions of the software as new elements are introduced into the system without having the changes compromise the working of the rest of the software; and, most of all, the ability to check out the system, so as to make sure there are no conceptual errors in the software in such matters as handing over tracks of the offensive missiles, transferring automated decisions from one node of the system to another, avoiding loops in the logical sequence, and so forth.

How could such capabilities be tested? Can on-orbit testing be used? Such problems are just beginning to be addressed, and it will take a long time before conclusions can be drawn even as to what the state of this particular technology is compared with what is needed.

VI

In terms of future defensive technologies, what potential defense systems are technically feasible?

It is technologically feasible to create a *terminal defense* overlay of hard ICBM silos, deployed so that the missiles are moved among multiple silos and so that their position at any one time is unknown to the attacker. Such a defense overlay can, by preferential defense—that is, defending only the occupied silos—provide a cost-exchange ratio favorable to the defense because the attacker must attack all silos. The same is probably true of defense of moderately hardened mobile missile systems by a terminal defense of corresponding mobility and hardness. In the case of hard-silo defense, a single layer of defense by endoatmospheric ground-based interceptors would suffice. For mobile hardened missiles, a two-tier ground-based system would probably be needed.

Modified ground-based defenses using similar technologies could protect some other military targets, for example command and control centers. The exchange ratio at the margin will vary widely, however, among classes of such targets according to their nature (hardness, area and mobility), their number and their cost. Such defenses could also be deployed for a thin protection of some urban-industrial areas, though they must be recognized as protecting such targets, if at all, only against attacks that are both limited in size and not responsive (i.e., not modified to take account of the defenses). Terminal defenses for these categories would use two-tier ground-based interceptors, and until the early 21st century would need to carry nuclear warheads in at least the exoatmospheric long-range tier. The defenses would be accompanied by space-based early warning and tracking sensors, and by airborne optical sensors to aid in the discrimination task during the terminal phase.

Advanced versions of infrared sensors deployed near or above geosynchronous orbit (an altitude of 20,000 miles) will be needed for attack warning and assessment in any defensive system, even if no boost-phase intercept is attempted. Infrared or other sensors in lower orbits (at altitudes of hundreds of miles) would also be useful to all layers of a ballistic missile defense system for tracking and discrimination. But the sensors must be able to survive. This suggests that they be provided with some self-defense, which in turn could be the first step toward boost-phase intercept.

As to weapons, kinetic-energy rockets based in space are technologically feasible. But an ICBM using a fast-burn booster clearly defeats them, and space-based defenses are vulnerable to defense suppression. Estimates of the exchange ratio for a *boost-phase intercept* defense layer based on kinetic-energy kill range from as low as two to one adverse to the defense at the margin (assuming unresponsive offensive threats and including sunk costs for the offense) to more realistic estimates, assuming responsive offenses, of five or ten to one. Defense suppression would probably further shift the ratio in favor of the offense.

Space-based chemical lasers seem feasible in technological terms but more questionable in practical systems terms. Though likely to be faster in response than kinetic-energy weapons, they still will not be a match for fast-burn boosters of offensive missiles. They will, moreover, be vulnerable to defense suppression systems based on other space-based lasers, and also vulnerable to ground-based lasers and direct-ascent antisatellite weapons. Ground-based lasers, whether free-electron or excimer lasers, are interesting future technologies and may be more effective than chemical lasers, but it is too soon to know.

It should be noted that even though fast-burn missiles could thwart a boost-phase intercept, this still leaves the possibility of a *post-boost tier* or layer in an SDI system. The deployment by the offense of warheads and decoys cannot occur until later in the trajectory than the boost phase, at a higher altitude in order to avoid atmospheric drag. But the technology for post-boost intercept capabilities is likely to be difficult to achieve, because it will require electronic examination of images (pictures), using ordinary or infrared light, to distinguish among various components: the burned-out upper stage of the missile, the post-boost vehicle, and the various objects released from it. These requirements, the countermeasures, and the potential technological capabilities for a post-boost layer of defense are just beginning to be considered.

Which technologies would be useful in the next tier, in *mid-course intercept*, is still less understood. Presumably the defense would want to use the same kill methods (kinetic-energy and directed-energy weapons) for intercepts as in the other tiers. This has the advantage of allowing some of the absentee satellites[5] to come into play because of the longer time period involved in mid-course flight of a missile. Discrimination among possibly colossal numbers of objects would, however, be a daunting problem. There are ideas about how to address it, but no confidence in any of them; that is why there is a drive toward consideration of "active" discrimination, which would impart energy to the objects in the threat cloud in order to be able to distinguish among them by observing the effect on their behavior. Thus, mid-course intercept is unlikely to play any role in a deployed system until well after the turn of the century.

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[5] Satellites in nonsynchronous orbit trace out a path over the earth whose pattern and timing depends on their altitude and velocity. Absentee satellites are those whose position in their orbits, at the time when the attacking missiles are launched, puts them over parts of the earth that are distant from the offensive launch sites.

Through all of these considerations is entwined a serious problem for space-based ABMs: however effective space-based systems may be against ballistic missiles, they would appear to be more effective in suppressing defenses. And direct-ascent antisatellite systems or ground-based lasers may be still more effective than space-based systems in this latter role.

In sum, given the state of present and foreseeable technology, a boost-phase or post-boost phase intercept tier is not a realistic prospect in the face of likely offensive countermeasures and the vulnerability of those tiers to defense suppression. It will also exhibit unfavorable relative marginal costs as a contributor to defense of population at any reasonably high level of protection. These judgments apply to any system beginning deployment at least for the next 20 years, and probably considerably beyond then.

There are interesting new technologies, however, that leave open the possibility that our estimates of the offense-defense balance might change after that time, especially if some of these technologies prove to have some mid-course discrimination and intercept capability, as well as some boost-phase effectiveness. Such a shift is very unlikely, but strategic thinking should include the possibility that it might take place in terms of deployed systems some decades into the next century.

VII

What would a defense system look like if the priorities of the Reagan Administration's SDI program (boost-phase intercept and population defense) were to be combined with the technologies that will be available and a reasonable development program leading to deployment around the year 2000?

It would be likely to have space-based components. It would perhaps include, for example: a dozen satellites at one-half to two times geosynchronous altitude to carry out boost surveillance and tracking; some tens of satellites at perhaps one thousand kilometers altitude to carry out surveillance, tracking and fire control for the attack of boosters, post-boost vehicles, and objects in the mid-course part of the trajectory, using infrared detection (short wavelength for boost, long wavelength for mid-course) and laser designation, and possibly some semiactive radar or laser radar tracking; some thousands of satellites, at altitudes of a few hundred kilometers, whose main purpose would be to carry kinetic-kill vehicles, of which there would be a total in the tens of thousands for use as actual defensive weapons.

In parallel, terminal defenses would also be deployed. These would include terminal radars and an airborne set of optical and infrared detectors. There would be some thousands each of exoatmospheric and endoatmospheric interceptors, deployed around missile (ICBM) silos, other military targets and major urban-industrial areas. Some of the endoatmospheric interceptors might even reach out into the later parts of mid-course flight. To moderate the costs of putting into orbit the space-borne component of the system, a new and advanced shuttle would be developed and put in use beginning about 1997.

A supplementary deployment or second phase could be expected to commence eight to ten years later, thus beginning somewhere between 2005 and 2010, and taking another five to seven years to complete deployment. During that phase there would be added satellites carrying chemical lasers for killing offensive targets, and lasers or neutral particle beams for discriminating in mid-course as well. Alternatively, ground-based lasers with mirrors in orbit would be deployed, perhaps as early or perhaps three to five years later still. This second phase carries us into the realm of hypothetical technologies and cloudy crystal balls; X-ray lasers and electromagnetic rail guns lie still deeper in those realms.

Whatever the system architectures, there must be consideration of the possibility—and the effect—of catastrophic failure of one layer of a multitiered defense on the subsequent layers. In both the quantity of hardware and the nature of the software (that is, the built-in operational procedures), the systems must therefore be designed to provide a way to avoid catastrophic failure of a later layer (and thus overall failure) because of a poorer-than-expected performance of earlier layers. The simple multiplication of attrition factors in a series of layers, the number of which is sometimes rather arbitrarily assumed, carries an inherent assumption of its own. The assumption is that the operation of each layer's sensors, tracking, kill mechanisms and effectiveness is completely independent of the nature, physical components and effectiveness of all the previous tiers. The architecture of the entire system has to be such as to assure that this would in fact be the case to the maximum possible extent; also, to the extent it is not, to assure that the system degrades "gracefully." This will not be an easy or inexpensive task.

VIII

What would constitute an appropriate research and development program?

Though existing technology and system concepts for terminal defense can provide an effective defense of hard ICBM silos deployed in a multiple protective shelter mode, more advanced technologies—optical trackers, more accurate interceptors and lower interceptor yields—would increase the system's cost-effectiveness. For improving the contribution of terminal defense to protection of urban-industrial areas and, possibly, of military targets other than missile silos, the technology associated with non-nuclear kill and with terminal discrimination should be pursued. These would include greater tracking accuracy, homing warheads and the airborne orbiting adjunct. Deployment of a prototype developmental version of a terminal defense complex at a test range (Kwajalein) would be extremely valuable, and consistent with the ABM treaty.

Early warning and attack assessment systems should be further developed, including those based on detection of the infrared signal from missiles in a boost phase. To this end, improvements in the present Satellite Early Warning System should be carried out. Infrared, optical and radar tracking of objects in space from distances of up to about a thousand miles will also be useful for any defensive system. The corresponding R&D should therefore be vigorously pursued.

Because kinetic-energy weapons and conventional chemical lasers will be defeated by, or suffer a severe cost-exchange disadvantage from, offensive countermeasures and defense suppression, the R&D program should concentrate on the more advanced kill mechanisms and active discrimination methods that are further off in time. Such an approach, however, is legitimately subject to the criticism that "the best is the enemy of the good." Moreover, the effectiveness of future technologies is easily overestimated simply because less is known about them.

If one judges that the good is not good enough, then it is appropriate to work on something better (and therefore usually further away in time). This conclusion depends, however, on a judgment that successful development of such an advanced technology has a good chance to improve the defense's position in the balance between defensive measures and countermeasures. This last criterion may turn out not to be met even by the more advanced technologies for active discrimination and kill. For example, it continues to appear that everything that works well as a defense also works somewhat better as a defense suppressor. But the balance between offense and defense seems even less likely to shift in favor of the defense as a result of the nearer-term technologies than as a result of the more advanced ones. Thus, it is appropriate to increase the R&D emphasis on such programs as:

—optical technology, including, *inter alia*, the following elements: adaptive optics, i.e., adjusting the wave-front shape to compensate for distortions in the laser source and in the atmosphere; locking the phase of separate lasers together so their amplitudes add, greatly increasing the brightness; using one laser to drive another; phased-array lasers (for improving intensity, steering capability and atmospheric compensation);

—combining lasers and particle beams as a way of focusing the beam better;

—excimer and (especially) free-electron lasers, and the kill mechanisms based on those technologies; application of advanced optical technologies to chemical lasers;

—ground basing of lasers, and pop-up mirrors (which should be less vulnerable) or mirrors that unfold and that can be more easily deployed to make them less vulnerable as targets;

—verification technology for computer programs, fault tolerance, expert systems and automatic programming—in order to improve confidence in software;

—active and perturbing discrimination and other mid-course signature work (since the mid-course part of the flight gives the defense a longer time to act, *if* discriminants can be found for use by the defense); and

—survivability of space-based defensive components, especially sensors.

Bomb-driven X-ray lasers could be very effective because they could achieve very high brightness and medium beam width. But they are at such an early stage that the program, while deserving support, should be confined to demonstration of those two features. Rail guns may be useful but only if they meet very ambitious goals for speed, mass and multi-shot capability. Even then, conventional rockets accelerated to equally high speeds (and with correspondingly heavy propellant weight) may be competitive with rail guns; but neither is likely to be cost-effective.

Demonstrating the technology to achieve the above goals for X-ray lasers and rail guns should precede any consideration of a systems effort for them.

IX

In the light of the considerations set forth, what should be the emphasis of the SDI program? What should be the balance among systems design, component development, experimental demonstrations, and technology? What should be deemphasized or eliminated? These questions become more acute in the light of the substantial reductions in the funding of the research and development program from the proposals formulated in the Fletcher Committee Report of 1983.[6] Though congressionally approved funding is likely to exceed $2.5 billion in the current fiscal year, the scope of the program is so ambitious that schedules set only a year ago for systems decisions appear to be slipping, and some difficult choices about priorities will have to be made.

It would seem appropriate to emphasize technology that still needs to be proven and developed, rather than "spectacular" demonstrations—though at some point demonstrations would be needed to test the technology. Some technologies are sufficiently demonstrated, and the corresponding systems concepts sufficiently clear, so that engineering development could begin on them relatively soon. But doing so would make sense only after a decision as to the detailed nature and function of the defensive system.

1. Work is indicated to define the design of a ground-based

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[6] The work of this committee, headed by Dr. James C. Fletcher, was published in the unclassified report, "Strategic Defense Initiative: Defensive Technology Study," U.S. Department of Defense, March 1984.

terminal defense system, which could stand by itself or be a layer of a multilayer strategic defense system. This would involve updating the Spartan and Sprint missiles, and beginning work on the design of a non-nuclear interceptor. This system should have the capability of being deployed as a defense of the U.S. ICBM force, as well as serving as a component of a population defense if that should ever prove feasible.

Initiation of full-scale engineering development for such terminal defenses should be deferred for several years. This would allow two prior determinations. One is the technical and military feasibility (and political acceptability) of less vulnerable modes of ICBM deployment. The second is whether mutual reductions in the size of strategic offensive forces can be negotiated, to reduce the need for active defense of ICBMs. An appropriate schedule would be to get the technology ready for a possible 1988 initiation of full-scale engineering development, and a start of deployment in the 1993 time frame if such a decision is taken.

2. Space-based kinetic-energy weapons appear unpromising in the light of the almost certain offensive countermeasures, and therefore should be deemphasized, even though such a system is the only space-based one that could be reasonably well specified today. By the same logic, it would make sense to delay a decision on detailed specification of and initiation of full-scale engineering development on any boost-phase intercept system until 1994 or 1995. By that time enough ought to be known about the technology of the various directed-energy weapons to allow a more informed choice among them.

3. A full-scale technology program (phasing into development as particular technologies reach that stage) on boost-phase surveillance, mid-course surveillance and tracking is fully warranted. Boost-phase surveillance capabilities will augment early warning of attack; mid-course surveillance and tracking will augment attack assessment capabilities. These functions are justified even in the absence of a decision to proceed with active defense of population. Like the terminal defense development activities, they are consistent with restrictive interpretations of the ABM treaty. But they would also constitute the eyes of a strategic defense of population or of military forces against ballistic missile attack, should such a defense be decided upon.

4. A full program on adaptive optics, phase compensation and phase conjugation devices, phased-array lasers and related optical technology should be emphasized strongly, since obtaining the brightness and beam accuracies required for effectiveness even in the absence of offensive countermeasures depends strongly on these technologies.

5. The electromagnetic rail gun, bomb-driven X-ray laser, and (probably) neutral particle beam programs all belong in the preliminary technology stage. If they work they would be useful in specific functional areas of a strategic defense system, but they are in too preliminary a stage to justify putting them

in the component development category.

6. The directed-energy weapons segment of the program should be tilted toward the excimer and (especially) free-electron lasers, with emphasis on ground basing the energy sources and consideration of space-based mirrors as the pointing mechanism. Work on space-based chemical lasers should emphasize ways of making them brighter—such as phased arrays—within the limitations imposed by space basing; it is probably too early to abandon chemical lasers completely.

This orientation of the program would, as a separate matter, delay conflict with the ABM treaty while permitting rapid development and even preliminary testing of technology. It corresponds to an acceptance of the judgment that the program dates are ambitious even for the more developed (and less promising) technologies, and concentrates on the less developed but more promising ones.

That approach would defer until after 1995 the decision on full-scale engineering development for the directed-energy boost-phase intercept segment of the program that could involve space-based components generating or transmitting very high energy densities. Such a schedule, however, might prompt concerns that it was so far in the future as to undermine congressional and public support for the program. But that factor works both ways. Though there is real public support for strategic defense, both the expert and congressional communities are doubtful about the vision of protecting populations from a nuclear attack by means other than deterrence through the threat of retaliation. They are also concerned about the potential negative effects of SDI on arms control. Moreover, even those defense tasks and system components that look most promising are subject to serious policy objections regarding their deployment or testing. Thus a sign of willingness to pursue a more modest track, with long-term goals, and more care about arms control, would probably favorably influence a decisive segment of congressional votes on program funding.

To sum up, the near-term prospects for ballistic missile defense capabilities are reasonably well known. Technically, they appear cost-effective for defense of some kinds of strategic retaliatory forces. For defense of populations against a responsive threat, they look poor through the year 2010 and beyond. The prognosis for the longer term for this latter objective in the contest between defense and offense is less certain. It still looks questionable, at best, for the defense, because of some fundamental problems of geometry and geography, and the physics of offensive countermeasures and defense suppression in their contest with defense.

CHEMICAL LASERS

Senator STEVENS. Thank you very much, Mr. Secretary.

As I understand your articles, you basically criticize the timeframe as you have here today, but you also have some professional judgment concerning portions of the current SDI program.

For instance, I gather you would recommend increasing the effort in the chemical laser area.

Is that right?

Mr. BROWN. No; actually I would tend to increase the effort in the free electron laser, ground based, because I think that one is more promising. It puts less of the system in space where it is likely to be most vulnerable. It is also farther away in time, which may be one reason that it looks more promising.

I would not drop the chemical laser work, but it does seem to me less promising than the free electron laser and perhaps even than the excimer laser which could either be space based or ground based.

What I do think is that the really near-term possibility, kinetic energy systems from space, which are essentially rockets fired from a satellite, are so easily countered that they do not offer the basis of even being close to cost effective.

I am not familiar with what the exact present thinking of the SDI office is, but I can see why they would be tempted to go ahead with the kinetic energy space-based system on the ground that, at least it can be ready earlier.

In other words, I think the program is caught between a rock and a hard place. It is caught in a dilemma. What can be done soon, if you want to call 15 years soon, is clearly much less capable.

If, on the other hand, you say we are only going to work on what offers considerable promise, more promise for us, a greater possibility of a favorable exchange ratio and of low vulnerability, then the time scale is not a short timelike 15 years; it is 25 or 30 years.

Who is going to get the Congress to put up money for something that is 30 years away? It is a dilemma.

Senator STEVENS. It is indeed a dilemma.

I want to limit my time to 5 minutes because I think everyone ought to have a shot at asking you a question or two.

SOVIET ADVANCE IN GROUND-BASED LASERS

It is my judgment that the Soviets are further ahead in the ground-based laser technology than we are.

Mr. BROWN. They are ahead in ground-based ABM deployment capability, but that also includes, of course, systems of rockets fired from the ground. If they were going to begin to deploy something substantial all over the country during the next 5 years, that is what they would deploy.

ONE-FOR-ONE RESEARCH THEORY

Senator STEVENS. Based on that judgment then, Mr. Secretary, it appears that following the suggestion you made would put us in a one-for-one kind of research. They are involved in this ground-based laser and other ABM systems.

So, you recommend we do that. The SDI program is multifaceted now, exploring a whole series of options and I think we all agree that the time must come when we have to narrow down the options, but currently they are exploring the whole series?

Mr. BROWN. Yes.

Senator STEVENS. It is that array that appears to attract the most attention of the Soviets. I do not think they would be disturbed if we were doing the same thing we know they are doing.

Mr. BROWN. We will, in any event, be doing something different from what they are doing. We will certainly have a considerably greater space-based component in our development program.

Our data processing, our discrimination program, the functions that rely on sensors, in all of which we are probably somewhat ahead of the Soviets—in data processing and software we are much farther ahead—will be emphasized in the SDI program. There is no question about that.

I would also say, whether hard-point defense should be built or not, it at least seems feasible. We ought, therefore, do some ground-based, hard-point defense research and development. That would not necessarily emphasize lasers. It would probably use rockets.

I was concerned a year ago that the SDI office seemed to be completely deemphasizing that, and they were. The reason given was that it was far enough along so that the next step would be a production step and they did not think the time ripe for that step.

I think there is quite a bit more development to do there. I would emphasize that and I would emphasize the farther out directed energy weapons for space basing or for ground basing with mirrors in space. In doing that, I think we would bracket the Soviet program, which I agree has spent more money on ground-based lasers by quite a bit than the United States over the last decade.

I do not think they are ahead of us in lasers in terms of what they know and I do not think really that they are ahead of us in what they could deploy that would have any relevance to an antiballistic missile capability.

I think they probably could deploy, and that is a judgment, they could probably deploy an antisatellite ground-based laser before we could.

Senator STEVENS. Thank you very much.

Senator Proxmire.

Senator PROXMIRE. Senator Johnston and I would like to yield to Senator Chiles who I understand has to leave for a speech.

Senator CHILES. I will try to be very brief.

Secretary Brown, I want to compliment you for your article in Foreign Affairs. It certainly was an informative exposition of the significant technical problems we face in deploying a strategic defense.

The staff study conducted by Senator Proxmire and Senator Johnston and myself attempted to describe some of the hurdles ahead in the program.

SDI SCIENTIST/SALESMAN GAP

One of the important findings of our study was the gap that exists between the SDI scientists at the weapons laboratory and the SDI salesmen that are here in Washington. Both you and Secretary McNamara have been to the labs and received similar briefings.

I wonder if you found that same thing to exist and, if you did, whose assessment is more realistic?

Mr. BROWN. The caution that I sensed among the scientists and engineers at the laboratories and among many of the industrial contractors was not universal, but it was very widespread. It was not unanimous, but it was very widespread.

Some of the difference between that attitude and the attitude of headquarters people can, in part, be ascribed to the caution that technical people often show. It is regarded as a virtue in technical circles to be cautious and careful about what you say.

It is not always so regarded either in political circles or in headquarters circles. The Washington atmosphere is very different from the atmosphere where the work is being done. Hype is in in Washington. Indeed, to get attention either from the public or from the press or from the Congress, a certain amount of hype is sometimes required.

Finally, if I were running a program, I would want to give it a certain momentum, a momentum that might outlast the transitory nature of one administration or another. And to do that, I would want, first, to get a very high funding level; second, to have something to show, and the mixture of reality and appearance in that something depends on the circumstances.

I have explained what I think is the difference. It is clear where my sympathies lie. My own attitude is much more that of a cautious technologist. I would like to hope that that would be the case even if I had official responsibilities and was a policymaker and not merely an observer.

Senator CHILES. Thank you, Mr. Chairman.

Senator STEVENS. Mr. Proxmire.

Senator PROXMIRE. Thank you, Mr. Chairman.

Mr. Brown, we are delighted you are here. I cannot think of anybody who is better qualified to speak on this than you are.

First of all, you are independent. You are not beholden to a sitting President. You were in the past, but not now.

In the second place, you have the technical qualifications. I do not know anybody else who has more superior qualifications than you have.

In the third place you have been Secretary of Defense and an outstanding Secretary of Defense who has won respect from everybody in that regard.

Also, you were once Director—I did not realize that until this morning, of the Livermore Weapons Lab now doing research on SDI.

Mr. **Brown**. One of the places.

Senator **Proxmire**. That is right. It is viewed by many as the head lab.

LIVERMORE SDI RESEARCH PROGRAM

You received detailed classified briefings on the Livermore SDI research program.

We have been told by General Abrahamson it has already been determined that comprehensive strategic defenses are technically feasible. The only question is whether SDI is economically feasible and how long it would take to deploy it.

Do you agree with that assessment and has the Star Wars' technical feasibility already been settled, in your view?

Mr. **Brown**. In the sense that it does not contravene any known physical law, it is technically feasible. I think one needs to make that distinction. It is not a perpetual motion machine.

On the other hand, I think you have to include countermeasures by the offense in deciding whether something is technologically feasible or is feasible in engineeering terms. That, I think, has not been proven.

In particular the judgment that I make, and I think most people who know about this make, is that it is easier to destroy the space-based components of a strategic defense system than it is to destroy the ballistic missiles that raises a real question about technological feasibility of space-based SDI systems.

Senator **Proxmire**. You would argue that does not meet the Nitze criteria?

Mr. **Brown**. Does not meet the survivability criterion. Suppose you have two systems, a Soviet system and United States system, each of which is aimed at destroying the other's ballistic missile system. It will do a better job against the other's defensive system. That raises a problem of survivability. It raises a problem of stability. And, in my judgment, it raises the question of technological feasibility.

Is something technologically feasible under those circumstances? It is a matter of definition and maybe it is a moot point. It certainly is not a very good situation.

So eminent a proponent of SDI as Edward Teller has said you cannot base things in space because anything that will shoot down ballistic missiles will shoot down in space better than it will shoot down ballistic missiles.

This is all separate from the issue of cost-exchange ratio, between the offense and defense when the offense is trying only to penetrate the defense by overwhelming or fooling it, not by destroying it.

Senator **Proxmire**. I would like to get your evaluation of this because you are former Secretary of Defense as well as technical expert as to how much it will cost.

I understand you have given a figure of $1 trillion. I am sure you know it is so far away that it is hard to be dogmatic about the precise figures. I would like to go through it very quickly.

Technological development, research, testing, and so forth, has been estimated at about $50 billion over the next 10 years.

Mr. BROWN. The proposed program was originally $26 billion over 5 years. It is now obviously going to be stretched out, but the administration is still proposing to get up to an $8 billion a year level.

My guess is that the intent would be to go on at that rate for a long time. So that the development might well be $100 billion rather than $50 billion.

PRODUCTION GOALS

Senator PROXMIRE. Now, the production of hardware, kinetic kill vehicle, satellites, the mirrors, all that kind of thing, I have seen various assessments of that, $0.5 trillion.

Mr. BROWN. It depends on, among other things, how long the lifetime is, because it will take you 5 or 6 years, maybe 8 or 10, to put such a system into space and it is a question of how long the pieces will last in peacetime.

Related to that is the question of how much it costs to put a pound of payload in orbit.

Senator PROXMIRE. I want just the production first.

Mr. BROWN. It varies all over the map.

Senator PROXMIRE. $500 for kinetic kill vehicles, and you have 1,000 vehicles.

Mr. BROWN. I cannot really make a judgment in that degree of detail.

SPACE DEPLOYMENT

Senator PROXMIRE. Putting it in the deployment problem, that is, putting 20 million to 200 million pounds into space, it is $3,000 per pound now. They think they can reduce it for various reasons.

What is your judgment on the deployment?

Mr. BROWN. I would be surprised if the system, if it consisted of more than just some mirrors, and it must because the sensors have to be up there, can be put in space for less than $100 billion in transportation cost.

COST OF LIFTING KINETIC KILL VEHICLES

Senator PROXMIRE. Lifting the kinetic kill vehicles would be an enormous cost, would it not? Would that exceed $300 billion?

Mr. BROWN. Lifting it?

Senator PROXMIRE. Lifting all the kinetic kill vehicles they are projecting now.

Mr. BROWN. You are talking about 10,000 of them at least, probably more than that, because the offense is going to put up at least 10,000 targets, maybe 30,000 of them. They might weigh 10 pounds each, maybe more, maybe 50 pounds with all their appurtenances.

Then you have to multiply that by another 3,000 as things now stand. That gives you $50 billion.

Senator PROXMIRE. Fifty or five hundred?

Mr. BROWN. I think it gives you only 5 billion. But typically, payload costs are 10 times the cost of lifting them.

Senator PROXMIRE. I am putting another zero on it.

Mr. BROWN. Sorry about that.

Senator PROXMIRE. Maintenance and repairing, fixing hardware in space. You have to have a garage up there.

Mr. BROWN. That is an operating cost.

Senator PROXMIRE. Let me conclude by saying the total cost, you spoke of $1 trillion. It seems to me that is the total initial cost. You have an annual cost in research and annual cost in new deployment if you modernize.

You have to modernize this thing constantly, and an annual cost in maintenance.

Mr. BROWN. I think we may be seeing another example of overkill here, Senator Proxmire. I think $1 trillion may be an underestimate, but it is already so large an amount as to give anyone pause.

Senator PROXMIRE. As somebody who is a complete nonexpert, let me just say that I think if we do this, it could double the cost of our military expenditures if we really put this up there, kept it up there, maintained it and modernized it in anything like the President is talking about.

Mr. BROWN. Let us put it this way. You are talking in terms of annual cost if you actually deploy this and also deploy the air defense that you would have to deploy with it, about an annual cost that will be $100 or $200 billion. It will be in the $100 to $200 billion range, for the dream. You can do other things more cheaply.

Senator PROXMIRE. A branch of the service like having another department like the Navy.

Mr. BROWN. It could be worth it if it worked.

Senator JOHNSTON. I also want to join in the congratulations to you.

RESOURCES OF SDI PROGRAM

Our resources, those of us who are skeptical about this program, are not so great. We are faced with this array of scientists who are on the payroll who hype this program. Our resources are not that great. You are the principal among those resources we have because of your high credibility and because you are not trying to sell anything other than for the good of the country.

I do not have to encourage you to stay in the effort, but I do want to emphasize how important your role is here to all of us.

Now, first of all, I am exceedingly concerned about this hype. There is a hype in this program that ought to concern every American. We have seen it from the Director who is one of the best and I like him and he is a wonderful man doing a good job, I guess, in what his charter has been.

But his hype—for example, he testified the other day and I asked, "How can you protect space-based assets?"

He said, "Well, we can."

I asked, "How?"

He said, "It is classified."

We heard the classified explanation yesterday. I was not any more satisfied with the classified explanation than I was with the unclassified answer.

What I hear from you now is, if I wrote it down correctly, that space-based assets are so easy to counter that it is not effective and it is not sensible to deploy them, to deploy a system based upon space-based assets.

Did I write that down right?

Mr. BROWN. I was referring to the kinetic energy kill vehicle based in the space which are very easy to counter. It was about that version that I made the more sweeping judgment.

The judgment about space-based advanced systems or mirrors, using ground-based systems, has to be more equivocal. As a general principle, it seems to be easier to destroy systems that stay up in space a long time than it is to destroy ballistic missiles that just go through.

DEFENSE OF ORBITING VEHICLE

Senator JOHNSTON. Do you know of any effective way to defend your orbiting vehicle?

Mr. BROWN. I can think of possible defenses and, indeed, the SDI Office is working on them.

There are counters to those and when you get a few steps up the measure versus countermeasure ladders, then you can have more controversy about how it comes out. The people on the pro-SDI side say, "Your counter-countermeasures are not really as feasible as you say. They are much further off, whereas our counter-countermeasures are much closer." The anti-SDI people on the other side say the opposite.

Fundamentally, I think the space-based assets are going to be very hard to make survivable. That is a strong statement. It is not completely unequivocal, but I mean it as a strong statement.

Senator JOHNSTON. That is from the careful scientist that you were talking about.

Mr. BROWN. Yes.

Senator JOHNSTON. Actually you said it was not sensible to base defense on space-based kinetic kill vehicles because of the vulnerability of those?

Mr. BROWN. Yes.

Senator JOHNSTON. Our staff went to the labs and we have since written a report which says scientists at the Sandia Lab have come to the conclusion that space-based boost phase defenses can never be made survivable unless by treaty.

A letter in answer to that was produced yesterday from Sandia National Lab which counters that by saying that no definitive conclusion is appropriate at this stage of the research program.

The only conclusion that can be drawn is that survivability should be a major focus of our research, which is the scientists' careful way of saying we have not solved it yet, we do not know how to solve it, but give us some more money and we will continue to try.

Mr. BROWN. That is how I read that. I think they are denying that this is a certainty; that is, they are denying it is certain that you cannot maked a space-based boost phase interceptor survivable.

I agree that it is not a certainty; it is just very likely.

Senator JOHNSTON. Have you seen other examples of hype? You call them spectaculars.

Mr. BROWN. Hype pervades the national political scene. It is not confined to the SDI Office. I have always considered the claims of imminent destruction made by the nuclear freeze movement to be hype, also.

I think we just have to live with it, understand it. It even has its value in the democratic process, but you need to be able to see through it sometimes.

Senator JOHNSTON. One final question, Dr. Brown.

EFFECT OF SCHEDULE SLIPPAGE ON SDI PROGRAM

You have proposed in your article, which I have read, that trying to superimpose a calendar decision or matrix over what ought to be a scientific calendar results in premature decisions for development that will do the program harm.

My question to you is, keeping in mind the President's objective, if you can adopt that and I do not think it is realistic, but if you could adopt the President's objective, would the lessening of funding and thereby a slipping of the schedule—the Fletcher report says less than full funded might delay it 3 years—would slipping of the schedule 3 years by less than full funding help the objective or hurt the objective?

Mr. BROWN. In terms of making it an orderly technological development program, it would not hurt it; it might help it.

There are other issues. There are issues of negotiations with the Soviets. The President keeps saying it is not a bargaining chip. That is what he ought to say even if it is a bargaining chip because if I were he, I would not decide until the last minute, and I think he has not decided.

A major decrement in funding, halving of the funding by the Congress would certainly make that negotiating process more difficult.

Senator JOHNSTON. You mean halving last year's funding?

Mr. BROWN. Yes; cutting it in half or even cutting this year's in half.

The Soviets are clearly looking at what the Congress will do. They are now pretty sophisticated. This is new style Soviet leadership. They watch what the Congress does. They try to influence the Congress. They try to influence public opinion.

They would certainly like to see the strategic defense program, about which they worry for some good reasons and some bad reasons, decrease without having to pay anything for that.

If the Congress were to level it or decrease it, that would certainly reduce the price they might be willing to pay.

On the other hand, the difference between appropriating $4.8 billion and appropriating $3.3 billion is not going to be seen by them as greatly reducing their concerns about SDI, nor is it likely to reduce what they may be willing to pay to inhibit it.

Senator JOHNSTON. Thank you.

Senator STEVENS. Senator Cochran.

SOVIET RESPONSE TO SDI RESEARCH PROGRAM

Senator COCHRAN. Thank you, Mr. Chairman.

There was a statement made about the fact that we are going to cause certain fallout if we pursue the SDI research program, certain things are going to happen, the development by the Soviet Union of an antitactical ballistic missile system, the deployment of an antisatellite weapon system, and maybe there were some others.

I wonder whether or not the evidence is not sufficient to justify the conclusion that the Soviet Union is going to develop and deploy, or at least, certainly develop the capability of deploying an antisatellite weapon system whether we spend any more time on the Strategic Defense Initiative.

Do you agree?

Mr. BROWN. I was talking about capabilities that will be left in our own program. We will have an antisatellite capability well before we have antiballistic missile capability. The same thing is true of the Soviets.

How much one influences the other is obviously amatter of judgment. My judgment on that does not go nearly so far as Secretary McNamara's. Secretary McNamara was saying most of what they have done they did in response to us. I do not agree with that.

A well-known quotation of mine that is likely to be carved on my tombstone shows I do not agree with that.

Senator COCHRAN. I appreciate having that clarification because I worry that we are somehow confusing the issue, some of the rhetoric and some of the questions in terms of whether or not what is being done in space now by the Soviet Union was actually caused by us.

I think the fact of the matter is that over a period of time the Soviet Union has clearly been embarked on a program of research in the development of weapon systems that could be based in space, would use space technology, and that these threaten the security of the United States.

Do you agree with that?

Mr. BROWN. Some of them would and some of them not. I do not think Soviet navigation satellites or communication satellites threaten us. I think their antisatellite capability, although it is not terribly good, is a problem for us.

Some of their observation satellites have the Navy worried. But I think that they are not terribly effective, although they are meant to help the Soviet military capability.

I would say the Soviet response to the SDI will come in their defensive systems, too. I am sure that right at this moment in a less public forum Soviet advocates of a strategic defensive program from space and high-energy lasers are arguing their case by saying, "Look at what the United States is doing."

But I think that may only be a modest effect on the Soviet effort. I am quite sure, however, that the Soviet offensive force program is being accelerated and altered in response to what they see as a possible U.S. deployment of antiballistic capability.

I am sure they are working on penetration aids. I am sure they are working on defense suppression; that is, the ability to destroy space-based and ballistic missile capability.

They would be silly not to, just as we would be silly not to develop our penetration capability and, as Secretary Weinberger said in his letter to the President, the possibility of Soviet antiballistic missile capability calls for increased U.S. offensive force capability.

So, I am sure they are saying the same thing.

SOVIET RESEARCH INTO SPACE-BASED SYSTEMS

Senator COCHRAN. Whatever the impact on offensive strategy, I think it is clear, and I wonder if you agree, that we must recognize, to the extent that the Soviet research program is a threat to our security, that there has to be some effort made to develop a way to protect ourselves from that threat, whether you call it a vision, or call it a dream, or criticize the President's way of describing the program to the American people or not.

Mr. BROWN. The Soviets have a research and development program on strategic defense. It certainly includes ground-based antiballistic missiles. It has elements of the technology of a more sophisticated, more exotic space-based system.

Indeed that does pose a threat. It poses a threat to our retaliatory capability and thus poses a threat to our deterrent strategy.

In order to ensure against that threat, we need to make sure that our retaliatory forces will survive and be able to penetrate.

Very little of what I have said so far in this response applies to a U.S. strategic defense program. What I will say now does apply. We also need to have a vigorous research program on ground-based and space-based strategic defenses against ballistic missiles and against aircraft so that we will not be caught by surprise. I support such a program.

That is what is advertised by the administration part of the time, but it is not what is advertised most of the time.

Senator COCHRAN. I appreciate your statement.

Thank you very much, Mr. Chairman.

Senator STEVENS. Thank you very much.

SUPPORT FOR SDI RESEARCH PROGRAM

Thank you very much, Dr. Brown. We are pleased to have you appear before us. I think the hearing has demonstrated a broad spectrum of support for the research phase of SDI.

There is some disagreement as to the way the current research is being conducted, which is a healthy thing in a democracy.

We look forward to conferring with you further as we go along, Mr. Secretary. We welcome your advice and your comments at all times because we know of your great service to our Nation and also your very professional technical capabilities in this field.

I think you are unique in terms of those who have been involved in the past and are involved in the discussion now in that regard.

We are going to set aside May 9, if we can arrange for Dr. Brezezinski and Dr. Teller to join us and to present their views.

The subcommittee will take a trip to the field and visit at least four of the areas where classified research is being conducted and then we expect to have one further wrapup of this issue.

This is the largest request in the defense budget which has been presented to us. We feel that we should spend as much time as we possibly can in reviewing it.

So, we appreciate your willingness to help us and congratulate you on those two papers you wrote because they were very informative to us.

Thank you very much.

Mr. BROWN. Thank you, Mr. Chairman.

SUBMITTED QUESTIONS

Senator STEVENS. Senator Proxmire has requested that Dr. Brown respond to additional questions. They will be inserted in the record at this point.

[The following questions were not asked at the hearing, but were submitted to Dr. Brown for response subsequent to the hearing:]

QUESTIONS SUBMITTED BY SENATOR PROXMIRE

QUESTION: Dr. Brown, in your foreign affairs article, you come to a very sobering conclusion. In it, you say that, "given the state of present and foreseeable technology, a boost-phase or post-boost phase intercept tier is not a realistic prospect in the face of likely offensive counternmeasures and the vulnerability of those tiers to defense suppression." You go on to say that "these judgments apply to any system beginning deployment at least for the next 20 years, and probably considerably beyond then." A staff report that was prepared for Senator Johnston, Senator Chiles and myself on SDI quotes General Abrahamson as saying that "the boost phase simply has to work" in a comprehensive missile defense system. Without it a star wars system would be much too costly and expensive. Your concern about the boost phase ever being effective in the next two decades or beyond raises a serious question about whether a comprehensive strategic defense system can ever be made effective. Would you care to comment on this?

Dr. BROWN: I doubt that it can, in terms of population defense. There are some special circumstances where it might be made effective, such as a verifiable limitation of offensive warheads to say 100. But in general, the prospects seem very poor to me, at least for 20 years, and probably for at least more decades beyond that.

QUESTION: Dr. Brown, you say that a fast-burn booster can defeat kinetic energy rockets. If this is so, the feasibility of Star Wars would seem to come down to the prospect for Soviet development of fast-burn boosters.

Dr. BROWN: A fast-burn booster is an excellent and fairly simple response to kinetic energy weapons from space, and a good but less effective response to directed energy weapons from space. It is by no means the only response to either.

QUESTION: General Abrahamson has said that he is attempting to define what Star Wars should cost, instead of what it would cost based on what we now know. In other words, a missile interceptor should cost $500,000 instead of $5 million. A sensor satellite should cost $50 million instead of $500 million. It should cost $200 to lift a pound of material into space instead of $3,000.

It's all well and good to set these low cost objectives. But how realistic are they? Based on your experience with military RDT&E and production, can we drive these costs down by these huge orders of magnitude in order to make Star Wars affordable?

Dr. BROWN: It is worth trying to get all military materiel costs down by a factor of ten. But aircraft carrier costs have gone from $1 billion to $4 billion, not to $100 million. And management problems, inflation, and congressional micromanagement are only part of the reason. Most of the reason is escalation of the threat (real and hypothetical) to which they must respond. The same thing is likely to happen to SDI.

QUESTION: Dr. BROWN, in your Foreign Affairs article you note that we might be able to deploy space-based kinetic kill vehicles some time between 1995 and the year 2000. In fact, this is the near-term option SDI is considering because these kinetic kill vehicles represent the most mature technology. But won't this system soon have severe limitations after it is deployed as the Soviets refine their countermeasures and perhaps evolve into the fast-burn boosters? Should not kinetic kill vehicles be considered a short-term deployment option if we were going to go into a full-scale Star Wars system that would last decades and decades?

Dr. BROWN: Yes.

QUESTION: Dr. Brown, SDI has been touting the research being conducted at Lawrence Livermore Laboratory into the Induction Linac Free Electron Laser as a Major breakthrough for the program. Certainly, there has been progress in free electron laser research. But could you put this in perspective for us? Could you compare the progress made so far with the hurdles we still face in producing a powerful laser, propagating its beam through the atmosphere, and developing the battle mirrors?

Dr. BROWN: There is significant promise in the FEL program. But increasing the power to levels of systems interest, all the interactions with the atmosphere, and the problems we are likely to discover in achieving those ends, are such that a decade or more of technology research and advanced development will be needed before full scale engineering development could be begun sensibly.

QUESTION: Can you talk about the battle management and computer system that would be needed to run a Star Wars operation and maintain it? How can this system ever be tested so that we can be sure it works and works right the first time? Or, can this system ever be fully tested?

Dr. BROWN: My views on this subject are contained in my article on Foreign Affairs. The whole system need not be tested all at once, in principle. But it would be so complex that we don't begin to know how to design and test it in pieces with any confidence that those pieces would work together properly, especially in the hostile environment it would face in wartime.

SUBCOMMITTEE RECESS

Senator STEVENS. We stand in recess until Wednesday, April 23, when we will receive testimony on Navy aircraft procurement.

[Whereupon, at 12:50 p.m., Thursday, April 10, the subcommittee was recessed, to reconvene Wednesday, April 23, 1986.]

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1987

WEDNESDAY, APRIL 23, 1986

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 10 a.m., in room SD-192, Dirksen Senate Office Building, Hon. Ted Stevens (chairman) presiding.

Present: Senators Stevens, Kasten, D'Amato, Cochran, Proxmire, and Sasser.

DEPARTMENT OF DEFENSE

DEPARTMENT OF THE NAVY

STATEMENTS OF:

VICE ADM. E.H. MARTIN, U.S. NAVY, DEPUTY CHIEF OF NAVAL OPERATIONS FOR AIR WARFARE

LT. GEN. KEITH A. SMITH, U.S. MARINE CORPS, DEPUTY CHIEF OF STAFF FOR AVIATION HEADQUARTERS, U.S. MARINE CORPS

VICE ADM. J.B. WILKINSON, U.S. NAVY COMMANDER, NAVAL AIR SYSTEMS COMMAND

JAMES DARR, DIRECTOR, PROCUREMENT BUDGET DIVISION, NAVAL AIR SYSTEMS COMMAND

NAVY AIRCRAFT PROCUREMENT AND RELATED RESEARCH AND DEVELOPMENT

BUDGET REQUEST

Senator STEVENS. I apologize to you. I had to attend a Rules Committee meeting before this one today.

The subject of today's hearing is the Navy's fiscal year 1987 budget request for aircraft procurement and related research. More than $11.3 billion is requested for aircraft procurement, nearly $700 million more than provided in fiscal year 1986 following sequestration.

Approximately $1.5 billion is also included in research and development to support future aircraft programs.

AIRCRAFT PURCHASE

The Navy's plan is to buy 271 aircraft this year, down from 310 aircraft funded in fiscal year 1986 and lower than the 329 projected for fiscal year 1987 last year. The major factor for this decrease is the

Navy's decision to terminate production of T–34C, UC–12B, and T–44A aircraft which had been planned at a rate of 77 aircraft in fiscal year 1987.

Offsetting these decreases is an increased procurement of 36 F/A–18 to a rate of 120 aircraft. In addition, the Navy plans one new start in fiscal year 1987, the SH–60F antisubmarine warfare carrier helicopter to replace aging H–3 assets.

There are several developmental program issues which require examination in light of the Navy's efforts to compress schedules and minimize costs of research programs. Further, the budgetary pressures facing the Congress force us to scrutinize production rates and cost effectiveness of program schedules to maximize the expenditure of Government resources.

I welcome you again, Admiral Martin, as the Deputy Chief of Naval Operations for Air Warfare, and am happy to have you here, Lt. Gen. Keith Smith, the Marine Corps Deputy Chief of Staff for Aviation. Admiral Wilkinson, we welcome you, too.

I would appreciate any remarks you wish to make and you may handle them as you wish. We are happy to have you, sir.

NAVAL AVIATION OVERVIEW

Admiral MARTIN. Thank you, Mr. Chairman.

Good morning, sir and distinguished members of this committee. It is a privilege again to appear before you to discuss the Navy's aviation program for fiscal year 1987.

Both General Smith and I have detailed statements that we would like to submit for the record, if we may, sir, but in addition, I would like to make a few remarks. I will be followed by General Smith who will then address Marine aviation.

Of course, Marine aviation is an integral part of Navy aviation. We work very closely together and we have the same procurement program. We are indeed inseparable in terms of operations and in terms of procurement. I would like to turn it over to General Smith after I have made a few remarks.

NAVAL AVIATION PROGRAM

I would like to discuss some elements of our program that I think are of particular significance. Mr. Chairman, naval aviation has enjoyed a very productive and successful year since I appeared before you last year in terms of readiness, force level, sustainability, modernization, and particularly with respect to safety.

600-SHIP NAVY

We have continued, with your help, on an upward trend in all of these areas. We are on track with our plan to provide the aviation forces necessary to support the 600-ship Navy, but we will need your strong support to maintain our course while ensuring that our readiness to respond remains at a very high state as it is presently.

As you know, the naval forces centered around our carrier battle group continue to provide flexible response to crises and contingencies that continue to emerge in this era of violent peace. Our carrier battle groups which are the very heart of naval aviation are the forces which we call upon first to help deter aggression and adventurism and to maintain peace and stability.

The *Achille Lauro* incident, the TWA 847, and the current events in the Central Mediterranean underscore my point in this regard. Presently we are well on our way toward achieving the 600-ship Navy. The center of this Navy, of course, is the carrier battle group. But the carriers, the supporting ships, the submarines, and the individual units themselves do not complete the warfighting equation. The ships must be equipped with modern, capable aircraft and weapon systems and be manned by competent, well-trained personnel.

CARRIER FORCE

The Navy requires 15 large deck carriers to adequately support our national security and foreign policy objectives throughout the world. This requirement continues to be validated as we see our carrier battle groups deployed around the world and operating face to face with the ever-expanding Soviet forces and their surrogates.

Presently we have two carriers operating in the Mediterranean, one carrier in the northern Arabian Sea, and we have had one there since November 4, 1979, when the hostages were taken. We have a carrier operating in the western Pacific, one in a training mode down in the western Atlantic, similarly, one in a training mode in the eastern Pacific.

We frequently deploy up in the Norwegian area. Our carriers are really being the workhorses of the Navy and supported by those ships necessary to fill out a carrier battle group. Most frequently it is the carrier that is chosen as the best instrument to demonstrate our commitment and intent in time of crisis because our carriers and our Navy are capable of operating from the high seas and from international air space away from the whims of foreign politicians.

MAKEUP OF NAVAL AVIATION FORCE

To outfit our carriers, our naval aviation force must consist of 14 active carrier air wings, 3 Marine air wings, and be supported ashore by 24 antisubmarine warfare and maritime patrol squadrons. These will be complemented by a modernized Reserve force composed of 2 carrier air wings, 1 Marine air wing, and 13 patrol squadrons.

This mix of forces is what is required to give us the reasonable assurance that we need to deter aggression and should deterrence fail, for us to prevail in time of conflict.

To build this projected force, we are proceeding with a balanced plan to fill the carrier air wings and patrol wings ashore. This is being done systematically while we strive to maintain peak readiness, keep the age of the force at a reasonable balanced and affordable level to assure stability in wartime, and provide the necessary level of modernization in the force.

I will now expand briefly on those points.

AIRCRAFT BUDGET

Our aircraft procurement appropriation, Navy or APN account request this year is the result of careful study of our requirements relative to the worldwide threat and particularly considering the fiscal constraints of which we are acutely aware.

We have been and continue to be critical of cost and we recognize our degree of responsibility to be good stewards of taxpayers' dollars. We have made every effort to develop a budget that meets the requirements and one which is both balanced and affordable.

The budget submission before you today represents a request for 271 aircraft and this is 58 less than I indicated we would need a year ago. Our request has been limited to essential sea-based combat, combat support and strategic mission aircraft at the expense of other support and training aircraft due to reasons of affordability.

By this reduced request, it may appear that we have reduced our procurement plan necessary to meet our needs in the future. I want to emphasize that this is not the case. We have structured our program recognizing that we have slid our requirements to the right somewhat in a belt-tightening effort and in a period of very austere budgets. We emphasized the procurement of tactical combat aircraft. As I mentioned, it is at the expense of training and support aircraft.

AGE OF AIRCRAFT

An important point in this regard is to recognize that our aircraft are growing older. The overall age of naval aircraft is 12.6 years with the tactical force currently at 10 years. We think this is pretty much an acceptable level. It requires somewhere around 329 aircraft per year to maintain the age of the force at the current level. This level has been achieved just recently after a decade of decline.

It is essential that we do not relive the horrors of the last decade during which we allowed our aircraft age to grow to the point that they were not ready, nor were they safe. If we do not do that—keep the age constant—we will pay a significant price with respect to our readiness to fight. By the systematic inclusion of maintainability and reliability into our procurements, we have ensured that newer, modern aircraft require less maintenance than their predecessors.

F-18 HORNET

The F–18 is a case in point. The F–18 Hornet continues to surpass our wildest expectations in terms of readiness.

The review of the recent mission in the Gulf of Sidra indicated they had a 95-percent complete sortie rate. This was unheard of several years ago. The number of maintenance hours per flight hour has dropped dramatically from what was anticipated.

ACQUISITION STRATEGY

No effort has been spared in our program to get more for less. We are trying to buy what is good enough. We are trying to avoid goldplating. We are trying to recognize that the very best that there is is the enemy of the good enough. We are trying to emphasize that which is necessary to achieve the maximum capability and sustainability for the dollar.

We have been successful in reducing cost by emphasizing competition in acquisition, improving our acquisition policies and by developing carefully planned procurement strategies vis-a-vis cost. We believe we have been successful in this regard with respect to the aircraft and weapons program for fiscal year 1987 that we are presently presenting to you today.

ACQUISITION POLICY

An area of concern, however, is the effect of the Balanced Budget Act on our acquisition policy. The Navy has gone to great lengths to implement a procurement strategy based on full funding of firm fixed-price contracts, careful risk reduction and the principle of Government being a dependable customer.

These will be undermined if reductions result in the termination or renegotiation of firm fixed-price contracts. Moreover, cost savings as a result of firm fixed-price contracts possibly could be abrogated.

I should add that these savings by firm fix-price contracting have been significant, $150 million in the case of the A–6F program, $200 million in the F–14, and $372 million in the T–45TS program. In order to retain these savings, every effort must be made to effect a modality that will accommodate and even exempt firm fixed-price contracts from the balanced budget reductions. Only in this manner will we be able to realize the enormous savings that firm fixed-price contracts provide.

The reduced level of aircraft procurements for fiscal year 1987 is not without penalty. A corollary to reducing our procurement profile will be a requirement to increase it in the future. As aircraft get older, readiness tends to fall off. More modifications and more spares are required as the aircraft do get older in order to meet the requisite capability.

READINESS

In the critical area of readiness we have a positive report to make. The overall mission capabable rate, which is the definitive measure of our ability to launch combat-ready aircraft, improved again last year. Our goal of 70-percent mission capable rate was achieved and I am confident that we will reach our goal of 73 percent in 1986.

The 71-percent mission capable rate achieved reflects an overall Navy rate, but if you look into the deployed aircraft rates, we reflect about a 74-percent mission capable rate. This is what really counts when you are facing the enemy.

The F–18 is presently exhibiting about a 77-percent mission capable rate while deployed. Again, this reflects the advantage of having advanced technology and building maintainability and reliability in our aircraft.

For those aircraft not incorporating such advanced design, we are stressing reliability and maintainability improvements with adequate stocks of spare parts. The most dramatic example of success in this area is the S–3A which is the carrier-based antisubmarine aircraft.

The S–3 Viking was produced in the early 1970's with less than adequate stocks of spare parts. Accordingly, the readiness of this aircraft was extremely low at that time, and yet today, because we bought the spare parts, it enjoys a position at the top of the readiness picture and is one of the most versatile assets that the commander of the battle group has at his disposal. We continue to stress this kind of combat support for our aircraft, solicit your assistance to maintain this ready force.

MODERNIZATION PROGRAM

The naval aviation modernization program is another means by which we capitalize on current technology without purchasing new aircraft. Whenever possible, block upgrades to existing airframes are being made to keep pace with the threat and latest technology at the lowest possible cost.

The S–3, F–14, the P–3 and A–6 aircraft are examples of weapon systems which are currently being modernized to keep pace with the threat through the 1990's. Each of these modification programs has undergone the most rigorous scrutiny to ensure that only essential warfighting capability is added or the improvements added on are the improvements that enhance safety, survivability, or the service life of the aircraft. Also always included in the modernization are the spares programs. As an example, the rewinging of the A–6E fits into all of the categories and it will provide a substantial return on the investment.

Once we have a modern force at sea ready to fight, the issue of sustainability must be addressed. I have previously mentioned spare parts and associated support equipment which is a prerequisite to maintaining a ready force.

AIR-LAUNCHED WEAPONS

In a similar fashion our weapons must be stocked in such numbers that we can sustain the fight in support of our maritime strategy. This is particularly true of the smart weapons, the missiles, guided bombs, and torpedoes which require substantial time to produce, but which would be used rapidly in the initial stages of war.

The air-launched weapons that we need are being requested in quantities necessary to sustain us and contracting methods are being emphasized to reduce our cost as much as possible while meeting inventory objectives.

NAVAL RESERVES

Another important aspect of sustainability is our Reserve force. We are continuing to pursue our plan to equip our Reserve wings and squadrons with modern front-line aircraft in order to ensure that the force comes ready to fight and is supported by a common logistic structure.

To this end we are continuing with the introduction of the F/A-18 in the Reserve wings and transition of other squadrons to the most up-to-date attack fighter and electronic warfare aircraft. Reserve VP squadrons continue to upgrade their equipment with introduction of the P-3C update.

Reserve squadrons will also play a key role in the introduction of land-based tankers, helicopters, combat support or search and rescue and airborne mine countermeasures aircraft. The Reserves are playing a very active role in naval aviation today.

AVIATION SAFETY PROGRAM

Our aviation safety program affects both our readiness and sustainability and it is one area which I am pleased to discuss. For the second consecutive year we have achieved a major accident rate of less than four accidents per 100,000 flight hours.

By comparison, when I first started flying in 1954, that rate was 56 per 100,000 flying hours and we killed over 500 people that year. We are looking at a host of initiatives to reach the next lower plateau in terms of safety and we think this will only be done by the addition of some specific things to aircraft such as the ground proximity warning system.

INTERSERVICE COOPERATION

I should like to turn now briefly to an issue that I know will become more important in years to come and that is interservice cooperation. The Navy is committed to cooperate whenever it will produce effective weapon systems at reduced cost. We are cooperating fully with the Army and the Air Force on programs such as the joint tactical data system, commonality in avionics in both current and advanced aircraft such as the F-14 and F-15 radars, remotely piloted vehicles, and Special Operations Forces aircraft.

MAJOR PROCUREMENT

In major procurement we are seeking common ground and continuing to pursue agreement on production of helicopters and V/STOL aircraft. The V-22 is an example of a multiservice procurement program which I think will be enormously successful. As you are well aware, this remarkable aircraft is likely to do to aviation what the helicopter did in the 1950's. The basic V-22 is a Marine Corps requirement for more than 500 aircraft and we have just recently determined that the V-22 will be the follow-on for the center zone ASW platform, the S-3.

We are also going to use the V-22 in combat SAR and the Army and Air Force are looking at it for a special operations aircraft and for the transport of troops. We think we will end up with an enormous number of these airplanes and that it will be used by all services.

We will continue to look at every avenue to explore means of commonality and joint service usage of all of our aviation programs.

Mr. Chairman and distinguished members of the committee, we think we have achieved significant results and significant progress in naval aviation in recent years. It has been largely as a result of your understanding and the support in this and other committees in this body. We would request that you continue this support.

I would now like to turn the microphone over to Lt. Gen. Keith Smith, Deputy Chief of Staff for Marine Aviation.

[The statement of Admiral Martin follows:]

PREPARED STATEMENT OF VICE ADM. EDWARD H. MARTIN

DEPUTY CHIEF OF NAVAL OPERATIONS (AIR WARFARE)

Mr. Chairman and distinguished members of the Committee, it is a privilege to present the Navy's fiscal year 1987 aircraft procurement request. In my brief discussion, I intend to describe how this budget request supports our maritime strategy and the fundamental pillars of effectiveness so necessary to this strategy--readiness, sustainability, modernization and force structure. In doing so, I will emphasize some of my concerns, such as the age of our aircraft force, and point out some of the successes of the past year.

The Navy is proceeding well toward a force structure of 600 ships. In the proper mix and degree of technological sophistication, this force will be capable of meeting projected threats into the next century. Ships alone cannot prevail in time of crisis or conflict; they must be well manned and equipped with modern weapons systems capable of meeting and countering the increasingly sophisticated threats.

The basic foundation of our modern 600-ship Navy is the carrier battle group, and the centerpiece of the carrier battle group is the enormously powerful and versatile aircraft carrier with her embarked airwing. It is the aircraft and their associated weapons systems that can take the fight to the enemy. They are the cutting edge of our deterrence posture and maritime strategy, supported of course by many associated systems.

A principal concern is to ensure that we structure our aircraft procurement programs in a balanced fashion, within the limits of affordability in order to keep this cutting edge sharp, effective and with the ability to sustain across the spectrum of potential threats. These threats range from terrorist activity to limited crises to global conflict.

During the past twelve months, we have worked diligently to put together a plan combining all of the elements of our aviation program--the aircraft, weapons, support equipment, spares and training systems--into a viable and affordable procurement request necessary to meet our fundamental requirements. We have recognized the tight fiscal environment which exists and are acutely aware of our responsibility to be good stewards of the taxpayer's dollars. Every effort has been made to reduce costs while maintaining our requisite capabilities. The result is an aircraft procurement, Navy (APN) request for FY-87 which shows a negative growth of minus 2.3 percent when compared to the FY-86 appropriation.

This negative growth is absorbed in all elements of the naval aviation programs and all four of the established pillars of force effectiveness--readiness, sustainability, modernization and force levels. In this tight fiscal environment, we are managing all of our resources with utmost care to ensure that we protect the gains that we have made in the past five years and that we continue toward our force level requirements of 15 deployable carriers, 14 active and two reserve carrier air wings, 24 active and 13 reserve patrol squadrons, and one reserve and three active Marine air wings.

The procurement program that is being presented today requests 271 aircraft, the bulk of which are sea based tactical aircraft necessary to provide the Navy with essential combat capability for our battle groups to meet their worldwide commitments. At this time a year ago I had hoped to procure 329 aircraft in FY-87. As a result of budgetary constraints, we have reduced that number by 58. Some very hard decisions have been necessary. Planned procurement levels of trainer and transport aircraft were reduced or deferred with preference given to combat aircraft. We have reduced the number of open production lines and incorporated more economic production rates for the high priority F/A-18, A-6E, and EA-6B programs. This procurement program is built upon a foundation designed to maintain a balance between requirements, available funding and optimal acquisition strategies. Our goal is to continue to ensure that we are able to put to sea a modern and effective force capable of meeting all commitments. It is axiomatic that we be ready for the unexpected and again this has been demonstrated during the intercept of the Achille Lauro highjackers and by the recent operations in the Central Mediterranean in the Gulf of Sidra. U. S. Naval Forces continue to operate at a high tempo around the globe in response to crises and contingencies, while maintaining a strong posture to deter aggression and adventurism.

Maintaining the highest state of combat readiness is essential if we are to meet these challenges. I am pleased to report that our readiness today is better than at this time last year. The key indicator of aircraft readiness, our mission capable rate, improved again as we exceeded our FY-85 goal of 70 percent, and we have raised the 1986 goal to 73 percent which I have every reason to believe we will achieve. Our newest addition to the fleet, the F/A-18, is demonstrating significantly improved reliability and maintainability compared to its predecessors. This not only points out that technologically advanced aircraft will be ready to answer the call more often but also that our policy of incorporating maintainability and reliability into our procurement strategy is sound.

Unfortunately, we are not reducing the age of our fleet of aircraft and age is a detriment to readiness. Older aircraft are more expensive to maintain and, more importantly to the operational commander, they tend to be less dependable. At the end of the Vietnam War, the average age of our aircraft was 8.3 years; today, the average age of our aircraft has increased to 12.6 years. During the past five years, the aging trend has been checked but not reversed. Currently, two-thirds of our aircraft are over 10 years of age and 40 percent are over 15 years old.

The 271 aircraft procurement program we have outlined in the FY-87 request will result in a continued increase in the age of the total force; however, since the bulk of those requested are tactical aircraft we will be able to maintain the vitality of our front line forces. This tradeoff will require correction in future years as the age of support aircraft increases. A procurement rate of 329 aircraft per year will be necessary to maintain the current age of the force considering prevailing attrition rates. This rate, incidentally, is less than expected, once again reflecting a superb safety record, with an accident rate of only 3.39 per 100,000 flight hours this past calendar year. I am delighted to report this and to assure you that we intend to continue to press for an even better safety record in 1986.

To offset the effects of the 12.6 year average age of aircraft, much emphasis is placed upon modernizing existing aircraft through a dynamic aircraft modification program, funded by APN Budget Activity 5. This is necessary when one considers that many aircraft now in the inventory will be in active service beyond the turn of the century. This will require periodic baseline configuration improvements to increase service life, solve in-service safety problems, and updating of capabilities to meet the ever improving threat. Major initiatives this year in the modification program are designed to provide capability, reliability, and maintainability upgrades to the A-6, F-14, and S-3 and SH-2 aircraft. Additional emphasis is directed toward common avionics and common ECM improvements which provide our aircraft with greater reliability in flight equipment and combat survivability.

Among the prime elements of material readiness are aviation spares, aircraft depot rework and support equipment. The S-3 Viking is a prime example of what adequately funded depot level component rework and spares can do. This key ASW asset rose from the bottom of the mission capable (MC) readiness records (less than 40% MC) when spares were underfunded to one of the best fully deployed systems (greater than 80% MC) in the fleet once adequate attention was given to spares support--a success story with convincing results. Last April, we commenced the aviation portion of the Navy's test of stock funding by including aviation repairables. Preliminary reports indicate that the results parallel those that were achieved in the non-aviation repairables test. An initial benefit has been an increased number of aviation components repaired, and a consequent increase in our "ready-for-issue" shelf stocks. This increase will provide an early boost to both readiness and sustainability. The parts will be there, in the fleet, whether needed for peacetime operations or wartime mobilization, resulting in significant improvement over our current situation.

Hand-in-hand with advances in the regular aviation force are initiatives to upgrade the Naval Air Reserve. The reserves represent an integral capability necessary to the total maritime strategy and maintaining modern equipment in the reserve force is essential to ensure a capable and credible force. Our budget request represents a balanced level of funding for both the active and reserve components.

Our progress in this area has been excellent to date. Two reserve fighter squadrons have completed transition to the F-14 aircraft with two remaining squadrons transitioning next year. Delivery of the F/A-18 to the reserves will commence in 1986 allowing two of the six reserve light attack squadrons to transition to the Hornet this year. The transition will parallel the fleet with a goal of making our reserve attack composition a mirror image of the active airwings.

Planned improvements in VP reserve squadrons will provide substantial increases in our reserve ASW capability. The first reserve squadron will transition to P-3C Update III aircraft in FY-88.

We continue to emphasize cost effective procurement for both the qualitative and quantitative improvements to our force (i.e., modernization and force levels). By the application of sound business and contracting techniques and procurement strategies we have had considerable success in bringing down the cost of aviation weapons systems.

Competition has become an integral part of the corporate approach to acquisition management. Our goal is to challenge and break down previous barriers to competition and make it easier to compete a program than to go sole source. We are positioning ourselves to sustain growth in competition in the long term. Where possible, programs are designed in the competition sense through development and several production lots.

Emphasis has been placed on the development of dual sources. There are presently 25 major systems or subsystems that have a second source, or are in the planning stage for dual sourcing. These efforts are paying impressive dividends.

Aggressive action to control the cost of aircraft weapons systems has also been set in motion. We are performing intensive reviews of subcontractor costs, which represent 40 to 60 percent of the total price of a major weapons system. Labor rates of both the prime and subcontractors have been closely monitored. Unrealistic increases have been disallowed. Overhead cost reviews of major prime contractors have been conducted to provide a better insight into the legitimate costs associated with overhead. The results of these efforts have been remarkable and we will continue to seek more efficient ways to reduce the costs of weapons systems while ensuring that quality and performance are maintained at levels required to meet fleet readiness needs.

We have taken positive steps to improve production effectiveness and reduce the number of production lines. We are on the schedule that I presented last year and will have 12 production lines open in FY-87. Additionally, we have adopted more efficient production rates for the AV-8B, F/A-18, EA6B, A-6E, and SH-60 helicopters which should result in significant savings over the life of these programs. For example, a savings of $2 billion is expected in the F/A-18 program due to these efficiencies.

Other aircraft which embody most of the elements of these strategies are the V-22 Osprey and T-45TS Goshawk.

The V-22A program has successfully completed its preliminary design effort and is ready to enter full scale development under fixed-price contracts for both the airframe and engine. First flight is scheduled for June 1988. The Navy, Marine Corps and Air Force are active participants in the development phase, with the Army joining in the procurement phase for a total program acquisition of 913 aircraft. The V-22A incorporates a new aviation concept combining the best features of a helicopter with those of a fixed wing turboprop aircraft. The V-22 will likely revolutionize the aircraft industry much in the same manner as the helicopter did in the 1950's.

While the initial emphasis for the V-22 has focused on the U.S. Marine Corps' requirement to rapidly and effectively move troops ashore during amphibious operations. In addition, the Navy plans to buy 50 combat search and rescue aircraft, and we are examining several variants with exciting potential. The largest requirement is for 300 ASW aircraft as the replacement for the S-3A Viking in the carrier-based fixed-wing antisubmarine warfare role. Additionally, we are studying applications for the Osprey in the vertical replenishment, Carrier Onboard Delivery (COD), organic maritime surveillance, and over the horizon targeting missions. Technological spinoffs are another fertile area that can be explored as this advanced technology is explored fully. We expect that the other services and civil aviation will order more Ospreys once it is in full-scale development and has demonstrated its enormous potential.

An essential ingredient in the modernization of our tactical forces is the modernization of the aircraft with which we train the tactical aviators of the future. The T-45TS is a systems approach to meet that critical need. An integrated system consisting of aircraft, simulators and academics is being built around the following requirements: the earliest possible initial operating capability to reduce the impact of shortfalls in training aircraft inventories;

the advantage of derivative technology which enables a firm-fixed price R&D effort; a procurement schedule which is executable; and an APN funding profile which is affordable. The full scale engineering development phase is well underway with a firm-fixed price contract which includes not to exceed prices for the first three production options.

Mr. Chairman, committee members, we have made significant progress in Naval aviation in recent years as a result of your understanding and steadfast support. Unquestionably, the resurgence of our military strength has signalled our commitment to halt adventurism and expansion in this turbulent era. Events have shown that Naval aviation is always the ready and effective tool to be employed in crisis situations throughout the world. With your continued support, we will continue to build upon our recent gains and improve our capability to deter aggression worldwide.

STATEMENT OF LT. GEN. KEITH A. SMITH

READINESS AND SUSTAINABILITY

Senator STEVENS. Good morning, General Smith.

General SMITH. Thank you, Mr. Chairman.

I would like to underscore a couple of things that Admiral Martin has talked about in his opening remarks. Readiness is better than it has ever been. I will return to that point just briefly in my opening remarks. The same goes for sustainability.

The support of the Congress of the programs that we have outlined has produced as predicted and the forces of both the Navy and Marine Corps have never been better.

SAFETY

On the point of safety, it is important to note that we have designed some airplanes from the ground up for the specific purpose of being more reliable and easier to maintain. In combination, those two aspects contributed significantly to the improvement in readiness of both the Navy and Marine Corps.

PREPAREDNESS

In terms of preparedness, in 1985 our mission capable average was 75 percent, up 13 percent from 1981. The bottom line you can use in an assessment of what that means is that there are 12 more Marine Corps squadrons that are operationally ready over 1981 on any given day.

The V-22 is in good shape. We have completed the DSARC. The system is coming along well in scale-up design and we have over 7,000 hours of wind tunnel experience to document that performance. It is really coming along beautifully. It is the Commandant's view and obviously mine that it is the highest priority program for Marine Corps aviation modernization.

The V-22 is being designed from the bottom up for reliability, maintainability, and capability, all those work together to give us aircraft that we need on a given day to do the chores at hand.

F/A-18

The second program I will touch on briefly is the two-seat F/A-18, a step forward in capabiity with a 1990 IOC. The two-seat F/A-18 procurement begins in fiscal year 1988. It picks up the mission of night attack in reduced visibility, but it is not total all-weather capable. It is a significant improvement in our eyes over the single seat airplane. We will operate both, however.

AV-8B

The second airframe that we are looking for is the two-seat trainer for the AV-8B. In order to train the crews safely and completely, we need the two-seat trainer of which there are six in the 1987 budget. It is the key to safe transition of pilots to the airplane that they will fly, the AV-8B. It is 90 percent common with the AV-8B and will assist us greatly in the night attack training role.

The only other program I would like to highlight for your attention and it is not necessarily within the jurisdiction of naval procurement. It is the tactical air operations module [TAOM] which comes under "Procurement, Marine Corps." I did not get a chance to talk to you about the TAOM but it is very important to us.

The TAOM gives us the command and control capability to bring us together in the most effective manner on the battlefield. It gives a two-thirds improvement in capability for one-third of the logistics support.

With those very brief comments, I will conclude my opening remarks by thanking the committee and the staff for your support and the success that we have enjoyed to date. We will work together with you any way we can to perpetuate that success in the future.

I am now ready for your questions.

[The statement of General Smith follows:]

PREPARED STATEMENT OF LT. GEN. KEITH A. SMITH (USMC)

DEPUTY CHIEF OF STAFF FOR AVIATION

Mr. Chairman and Distinguished Members of the Committee:

I appreciate the opportunity to testify before this committee on behalf of Marine aviation. On this, the occasion of my second appearance before the committee, it is a pleasure to report that 1985 was an even more productive year than the superb year before. My purpose is to provide an overall assessment regarding the status of Marine aviation today, as well as highlight Marine aviation programs contained in the President's FY-1987 Budget proposal.

Marine aviation provides one of the three components of a Marine Air Ground Task Force (MAGTF). The ground combat element serves as the core of the MAGTF with the aviation combat element and the combat service support element providing essential support. The capability to conduct successful tactical air operations is essential to the execution of amphibious operations. Marine aviation has, over a period of years, established and refined an organization with equipment required to support the MAGTF while ensuring a significant degree of commonality with Navy aviation forces. This demands a flexible and responsive aviation combat element task organized to meet the anticipated threat across the entire range of potential operating environments.

Let me emphasize that the Marine Corps is increasingly mindful of the trust placed upon us by the American people to ensure those resources invested are utilized in an efficient yet effective manner. Toward this end, review of our requirements is a continual and dynamic process. The intended goal is to provide the United States with a Marine Corps far more capable and prepared tomorrow than today.

Marine aviation preparedness has experienced a steady improvement over the past few years. For example, I reported last year that aircraft readiness had achieved a record high level of 72.9 percent. In 1985, this record was surpassed with a new overall aggregate readiness record of 75 percent mission capable. The most startling improvement, however, is reflected in the dramatic rise in the full mission capable rates from 39 percent in 1981 to 64 percent in 1985.

The cycle of technological reliance to counter the threat has often, in the past, caused an adverse impact on aircraft full mission capable readiness. New aircraft being introduced to the fleet today continue to possess the latest affordable technology, yet reflect a conscious and concerted effort to design systems which are reliable and maintainable. For example, the F/A-18 averaged 85 percent mission capable and 82 percent full mission capable for the year 1985. The AV-8B demonstrated an equally impressive 85 percent mission capable rate while achieving a 79 percent full mission capable rate for 1985.

A major contribution to the preparedness of Marine aviation is the Flying Hour Program. This program represents the major means of upgrading and maintaining the readiness of our aircrews much like the full mission capable and mission capable rates do for our aircraft. We have used the same building block approach to accomplish increases in both areas. In 1985, we flew over 350,000 hours which resulted in a significant and measurable increase in aircrew combat readiness. The flying hour request of 369,528 hours for FY-1987 is required to carry on this program and increase Marine Corps capability. Today, our aircrews are at their best state of readiness since Vietnam. In order to continue to be capable of providing combat ready aircrews on short notice, Marine aviation squadrons must maintain a uniform readiness posture.

Playing a vital role in maintaining our readiness by conserving irreplaceable men and costly equipment, aviation safety continues to challenge our operating forces. Overall, the accident rate for 1985 reflects a slight increase over the historic low rate of 4.63 per 100,000 flight hours demonstrated in 1984. The 1985 mishap rate was 5.23 mishaps per 100,000 flight hours. Marine aviation continues to be profoundly concerned with loss of lives and equipment. As a Corps we continue to adopt initiatives which should support further reductions in the mishap rate. Some of these safety initiatives include early identification and documentation of unsatisfactory aeronautical performance, improved dissemination of safety related information, and closer cooperation between aircraft manufacturer and operator.

Turning to the future, the V-22 development program remains the Marine Corps' highest priority. The strong congressional support expressed in the FY-1986 Budget has enabled the Department of the Navy (DON) to move forward with development of this vital program. As we rapidly approach the 1990's, our current medium lift aircraft, the CH-46, which has been in the fleet since 1965, will become increasingly unable to perform the pivotal role. The strategic and tactical applications of the V-22 far exceed the speed and range capabilities of existing CH-46 fleet of assault support aircraft. Independent of critical sealift and airlift, the V-22 may be strategically deployed over an unrefueled range of 2100 nautical miles. This capability enables timely marriage of aviation forces with those ground elements assigned to Maritime Pre-positioning Ships (MPS) brigades. The net effect is a "force multiplier" and a decrease in strategic airlift reliance.

The V-22 permits rapid unprecedented buildup of combat power ashore which is an established and fundamental principle of amphibious and vertical assault operations. American Marines may be employed well in advance of a combined surface assault to isolate the objective area and block potential counterattacking enemy forces. The V-22 capability of lifting 24 combat loaded Marines or 10,000 pounds of cargo reduces, by almost half, the time required to deliver the same load today. As the 250 knot cruise speed of the V-22 reduces the time between assault waves, it markedly improves force survivability through rapid buildup of combat forces in the early stages of assault operations. Equally important, these same performance characteristics will enable combat forces to reduce their vulnerability through dispersion, yet maintain the ability to rapidly concentrate combat power at the decisive time and place.

Negotiations recently concluded have led to an agreement on both airframe and engine development contracts under a total $2.5B development cap. A fixed price incentive contract for a not to exceed cost of $1.8B has been reached with the Bell-Boeing team. The airframe contract will produce six flight and three ground test articles. An additional feature requires a firm fixed price contract with options for a not to exceed cost on each of the first four production lots. The engine contract was awarded to Allison for the lease of 21 engines at a cost of $76.4M. In both cases, contracts were negotiated to ensure the V-22 is developed in the most economical fashion, while at the same time maintaining required capabilities.

Although the Department of the Navy is sponsoring the development of the V-22, the joint procurement program involves all four armed services. An initial buy of 913 aircraft provides the Marine Corps with 552, the Army with 231, the Air Force with 80, and the Navy with 50 aircraft. As the performance of the V-22 is fully realized in development, we are confident these initial procurement levels represent only a fraction of the combined services' requirement. Within the Department of the Navy alone, potential mission applications, including anti-submarine warfare, are being examined. Also, the application of tiltrotor to civil aviation is unbounded. The V-22 is our number one priority because it offers a significant enhancement and sustains the capability to conduct future amphibious operations.

The AV-8B represents another aircraft whose unique characteristics are particularly applicable to the expeditionary environment of amphibious operations. Uninhibited or restricted by fixed airfields, the AV-8B provides timely and accurate close air support to engaged ground forces. Flexible basing opportunities enable it to be dispersed and operated from several geographically separated sites, thereby decreasing aircraft vulnerability to enemy attack and improving responsiveness. A total of 328 AV-8B's are to be procured and distributed across the 8 light attack squadrons and one training squadron in the Marine Corps. Two squadrons are now operational, and a third squadron will transition this month. As the fourth squadron receives the AV-8B in FY-1987, conversion of existing AV-8 A/C aircrews will have been completed.

This coincides with the July 1987 introduction of the TAV-8B, a two-seat trainer aircraft for transitioning A-4 pilots and flight school graduates. The 28 total TAV-8B aircraft requirement is considered essential to safe transition of light attack aircrews and flight school graduates new to VSTOL operations. TAV-8B development is proceeding on schedule with the first flight set for December 1986.

In our fighter squadrons, introduction of the F/A-18 has been superb in every way. Reports from fleet commanders, Navy and Marine Corps alike, extol the virtues of this remarkable aircraft and the manner in which it has been introduced into the fleet. Today, three Marine F/A-18 squadrons are operational on the west coast with two of those squadrons currently deployed aboard the USS CORAL SEA in the Sixth Fleet. On the east coast, one F/A-18 squadron is operational with two more squadrons transitioning this year and two squadrons forming in FY-1987.

The versatility of this aircraft has provided the Marine Corps a unique opportunity to reorganize our existing fighter (VMFA) squadrons to capitalize on the F/A-18's inherent flexibility. With the introduction of the two-seat F/A-18, the existing 12 aircraft VMFA squadron will be increased to 16 aircraft. The Tactical Air Controller (Airborne)/Forward Air Controller (Airborne) and reconnaissance missions are to be assumed by the new organization. The eight single-seat and eight two-seat F/A-18's in each squadron will all be austere all-weather capable -- a feature born out of the current Night Attack Development Program.

The Night Attack Development Program provides a vital night and under-the-weather capability which enhances the already formidable capability resident in the F/A-18 and the AV-8B. The night attack program increases aircraft survivability while overcoming many of the obstacles associated with night combat operations. The low cost of this program is accomplished by developing components for the AV-8B which will also be utilized in the F/A-18. Costs associated with AV-8B equipment common to the British GR-5 aircraft are reduced through shared United Kingdom and American development funding.

Continued congressional support is required to complete the timely development of the Night Attack system for incorporation into future AV-8B and F/A-18 production models. The Night Attack system is be included in the FY-1987 procurement of the AV-8B and the FY-1988 procurement of the F/A-18. Future funding reductions would force a costly retrofit to ensure this capability is available in sufficient numbers. This austere feature complements the true all weather capability which is existent only in the A-6 series aircraft.

The A-6F development program is designed to ensure an all weather capability remains credible in the year 2000 and beyond. Current planning is for procurement of 150 production A-6F aircraft to be complemented by a modification program which could include up to 140 aircraft. The Marine Corps is to receive its first A-6F in 1993.

The CH-53E is approaching the third year of a four year multiyear procurement program and is essential to helicopter lift of the Light Armored Vehicle and the M-198 howitzer. It also has a self deployability range of 1000 nautical miles which may be further extended utilizing its inherent air-to-air refueling capability. Today, there are three CH-53E squadrons fully operational and available for deployment throughout the world. A single training squadron is based on the west coast and provides replacement aircrews. A fourth CH-53E squadron will transition from CH-53D's on the east coast in late 1987, providing a two squadron capability on each coast. The DON has approved an initiative to increase the number of CH-53E squadrons to six by 1994 in order to meet the DON amphibious lift requirement. This will be accomplished by transitioning two existing less capable CH-53A/D squadrons to CH-53E's.

Additional enhancements for the Marine Corps rotary wing force include fleet introduction of the AH-1W. The AH-1W is the latest in a series of growth versions of the AH-1 attack helicopter and features an improved T-700 engine package and the Hellfire missile system for increased capability and survivability. The first AH-1W was received by the Marine Corps last month. Also, Marine aviation began this past year to consolidate and realign the variety of dissimilar Light and Attack helicopter organizations into six uniform HML/A squadrons in order to provide a more efficient distribution of assets and balanced approach to contingency planning. These squadrons will now be assigned a mix of 12 AH-1 attack and 12 UH-1N utility helicopters.

Keeping pace with the tactical aircraft improvements, the Tactical Air Operations Module (TAOM) provides a state of the art automated command and control system essential to maintaining an integrated air defense for the MAGTF. Interoperability features enable linkage of this system to those of other United States services and allied command and control agencies. The modularized concept of the TAOM allows the system to be tailored to the scope and complexity of the operation. The TAOM is a joint program with the Air Force. The Marine Corps is the leader in development and procurement and will purchase 48 modules, while the Air Force is to receive 167. Acquisition is to be by a firm fixed price contract which features subassembly competition early in production and whole system competition in later years.

Another command and control initiative which appears before the Congress for the first time in FY-1987 is the Improved Direct Air Support Center (IDASC). The DASC is essential to the control and integration of close air support and assault support missions of Marine aviation within the MAGTF. The current DASC is old, worn out, and unsupportable due to a lack of replacement parts. The IDASC is a low cost initiative to resolve the supportability difficulty of the present system. IDASC uses in production components, shelters, and intercommunication systems which are fully integrated. Fourteen IDASC systems are necessary to meet force requirements.

As the capability of the Active Marine forces is modernized, so too are the capabilities of the Reserve Marine forces. Chartered by the guidance that those forces who are the "first to fight" will also be the first equipped, a balanced approach to total force modernization has been adopted. It is inevitable that some dissimilar equipment will be operational in the Reserve force as compared to their Active counterparts; however, this is not an insurmountable problem and we are actively pursuing initiatives for creative interim management. Nevertheless, Marine aviation intends to continue its efforts towards modernizing Reserve forces with aircraft similar to the Active force.

Modernization of Reserve aviation provides for replacement of aging aircraft and system enhancements to others. Ongoing transition to the more capable A-4M will be completed with the fifth squadron receiving their aircraft in late 1988. The ultimate goal for our Reserve fighter and attack fleet is to replace the A-4M/F-4S aircraft with eight F/A-18 squadrons. In other improvements, the number of attack helicopter squadrons will be doubled commencing in 1987, and the AH-1J will be retrofitted with the Hellfire missile system. Additionally, a second 12 aircraft aerial refueler squadron is to be formed at Stewart Airbase, NY. The OV-10D aircraft, which features a highly effective FLIR system, will be introduced in 1988.

The unique maritime character of your Marine Corps often requires imaginative solutions and bold responses to impending challenges. Refinement of close air support and vertical assault doctrine and tactics are illustrative of revolutionary responses to the changing requirements of amphibious warfare.

This report is intended to portray the progress of Marine aviation toward meeting the challenges of the future. In every direction, the judicious application of resources is intent on providing the degree of military precision this country has come to expect from her Marines. Your continued support is vital to ensuring the unique role of the Marine Corps and its aviation component in fulfilling our national commitment.

LIEUTENANT GENERAL KEITH A. SMITH, USMC

Lieutenant General Keith A. Smith is the Deputy Chief of Staff for Aviation, Headquarters Marine Corps, Washington, D.C.

General Smith was born in Cheney, Washington, November 11, 1928. He graduated from Cheney High School in 1945, and attended Washington State University from 1948 to 1952, earning a B.S. degree in Agriculture.

He enlisted in the Marine Corps Reserve on May 12, 1951, and attained the rank of sergeant prior to being commissioned a second lieutenant in the Marine Corps Reserve on June 6, 1952.

He completed The Basic School at Quantico, Va., in January 1953, and reported for flight training at the Naval Air Station, Pensacola, Fla. He was designated a Naval Aviator May 12, 1954, and the following month reported for duty with Marine Night Fighter Squadron 542, Marine Corps Air Station, El Toro, Calif., prior to being transferred to Marine Night Fighter Squadron 513 in Korea. In the spring of 1955, the squadron was redeployed to NAS, Atsugi, Japan, and General Smith completed that tour as Squadron Operations Officer. He was promoted to first lieutenant in August 1954, and to captain in July 1956.

General Smith was transferred to First Air Naval Gunfire Liaison Company, Camp Smith, Hawaii, in March 1956, as Air Liaison Officer. He returned to civilian life in February 1957, and participated with Reserve Marine Fighter Squadron 216, Naval Air Reserve Facility, Spokane, Washington, flying F9F6s; and Marine Fighter Squadron 541, Naval Air Station, Seattle, Washington, flying AD aircraft.

During December 1960, General Smith returned to active duty with the 2d Marine Aircraft Wing, Marine Corps Air Station, Cherry Point, N.C. He served as Executive Officer, Marine Air Control Squadron 6 and later, as S-4 Officer, Marine Wing Headquarters Group 1. In February 1962, he was reassigned as Officer-in-Charge of the cadre designated to build the first East Coast Marine F-4B squadron. The cadre picked up the colors of Marine Fighter Attack Squadron 531 in July of that year, and over the next three years, General Smith served consecutively as Adjutant, S-1 Officer, Aircraft Maintenance Officer, and Operations Officer. He was promoted to major in July 1963.

During April 1965, as a member of the first Marine F-4B squadron to see action in Vietnam, he flew 156 combat missions. For his service he was awarded five Flight Strike Air Medals and one Single Mission Air Medal. The squadron was awarded the Navy Unit Commendation Medal for its superior performance in South Vietnam.

He returned to the United States in July 1965, and attended the Command and Staff College at Quantico. Upon graduation, he was assigned as Head, Technical Training Section, Office of the Deputy Chief of Staff for Aviation, Headquarters Marine Corps. He was promoted to lieutenant colonel in October 1967.

General Smith underwent F-4 refresher training during March and April 1969, enroute to Vietnam for duty with the 1st Marine Aircraft Wing. He was initially assigned as S-1 Officer, Marine Aircraft Group 11, and in August 1969, he assumed command of Marine Fighter Attack Squadron 542 participating in 235 combat missions. In February 1970, he brought that squadron home from Vietnam and assumed command of Marine Fighter Attack Squadron 323, located at El Toro.

In June 1970, General Smith was ordered to Camp Smith, Hawaii, and served on the staff of the Commander-in-Chief, Pacific, as Plans Officer, Southeast Asia Plans and Policy Branch. In June 1972, he was reassigned as Head, Aviation Weapons Systems Branch, FMF, Pacific, staff. He was promoted to colonel in August 1972.

General Smith attended the Industrial College of the Armed Forces from August 1973 to June 1974, and upon graduation, reported to Headquarters Marine Corps as Assistant Deputy Chief of Staff for Requirements and Programs. He was advanced to brigadier general on May 24, 1976, and assumed duty July 2, 1976, as Assistant Deputy Chief of Staff for Aviation.

During May 1977, General Smith was transferred to the 1st Marine Aircraft Wing on Okinawa, to serve as Assistant Wing Commander and Commanding General, Ninth Marine Amphibious Brigade for the Team Spirit Exercise in Korea. On June 16, 1978, he assumed duty as Commander, Marine Corps Air Bases, Eastern Area and Commanding General, Marine Corps Air Station, Cherry Point, N.C. He was advanced to major general on April 9, 1979. In January 1980, he was assigned duty as Deputy Chief of Staff for Requirements and Programs, Headquarters Marine Corps. General Smith was assigned duty as the Commanding General, 2d Marine Aircraft Wing, FMF, Atlantic, MCAS, Cherry Point, N.C., in June 1981. Following his promotion to lieutenant general on August 28, 1984, he assumed his current assignment on September 1, 1984.

General Smith's personal decorations include: the Legion of Merit with Combat "V"; the Distinguished Flying Cross; Meritorious Service Medal; Air Medal with two gold stars and Numeral 26; and the Navy Commendation Medal.

Lieutenant General Smith and his wife, the former Shirley Lee of Hoquiam, Washington, are the parents of nine children. Kelley of Osaka, Japan; Timothy of Fairfax, Va., Holly of Alexandria, Va.; Cynthia of Seville, Spain; Lynn Turnbull of Long Beach, Calif.; Thad and Tadgh of the University of Wisconsin, Madison Wis.; and Tara at Virginia Polytechnic Institute, Blacksburg, Va. Vincent, a Marine captain, was killed in action in Beirut, Lebanon on October 23, 1983.

MILITARY OPERATION IN LIBYA

Senator STEVENS. Thank you, General.

Admiral, do you have any comments?

Admiral WILKINSON. I do not, sir.

Senator STEVENS. I want at the outset to say that we are going to poll the committee to see if other members are interested, but I would like to have a classified briefing on the Libya exercise. More than exercise; I do not know what we call it, operation probably.

We have a different interest than other committees. We would like to look into the cost effectiveness of the decisions that were made in terms of utilization of the aircraft and other aspects of the operation.

I want to announce that now in case other members might want to ask questions that could slip over into the classified concept. I do not think it is classified to get to the point of the use of the F-111's as opposed to relying on carrier-based aircraft, Admiral.

The question that I have faced most often is why did we have to bring in F-111's from such a great distance when we had two aircraft carriers in the Mediterranean?

Do we not have aircraft carrier-capable planes that could accomplish the same mission?

Admiral MARTIN. Mr. Chairman, I would like to qualify my answer to that as my opinion and my opinion is that of a former 6th Fleet commander, if I may.

I think there are three very valid reasons that we had a combination of the F-111 and the A-6's. The first is the number of targets that were desired to be struck simultaneously required so many airplanes.

Yes; all of those targets could have been struck from the carrier, but in so doing you would not have had a reserve to hold back in case this whole thing exploded. I think it was a very prudent decision and very wise one to use what forces were available and F–111's indeed were and they have enormous capability.

As you are well aware, the A–6 and F–111 are the only true long-range, all-weather, deep-strike, interdiction aircraft in the free world today. By using the F–111's and A–6E's it allowed the remaining carrier strike airplanes to be held in reserve, should they be needed for immediate follow-on action. That would be one reason.

A second reason would be by using the F–111's out of the United Kingdom, it allowed the United States and the United Kingdom to operate together. That is to say, the operation was not a stand-alone operation by the United States. I think that is a very valid reason.

The third reason I would offer, in my opinion, is that it allowed us to show Mr. Quaddafi that we had the capability to strike when the carriers were not in the area and, therefore, that he was not immune from such actions when our carriers were outside the area or we only had one in that area.

I would offer those three again as my opinions as to why it was a valid decision.

Senator STEVENS. We will follow that up if the other members have the same inquisitiveness that I do about the decisions involved.

V-22 PROGRAM

I am a little worried from what I hear about the House in terms of the V–22 program. My interest is not only professional in terms of the military, but it is highly provincial in terms of this new concept of air transportation.

I should like to make certain that it has a very clear analysis as far as its utility in terms of military requirement. The House, I am told, has a staff report that concludes:

> The basis for the decision to meet the Marine medium assault transport requirement with a costly tilt rotor aircraft is not clear.

I do not know who prepared that staff report, but I wonder about the mission definition if that is the conclusion.

Have you documented the requirement for the extra standoff range you would get with the V–22?

General SMITH. Yes, sir; we have. The document is available for any member of the committee that wishes to have one. Let me touch on it briefly.

The V–22 fits in the Marine Corps capability as the assault transport airplane and replacement for the CH–46E. It is much more than a replacement, it is an improved capability.

In the past, we have had to constrain assault operations because of the limitations of the CH–46 which the V–22 is replacing. Speed, range, and maneuverability are the life blood of weapons systems and it is important that we bring increased improvements in those three categories for the primary mission of the amphibious assault.

That, of course, gives us the capacity to operate across a wide beach battlefront in subsequent operations ashore. An amphibious striking force equipped with V-22's, CH-53's, and landing craft, air-cushion vehicles, can stand off shore 100 to 200 miles and provide a 24-hour threat to 700 miles of coastline.

With the CH-46's, our options are limited. The best we can do is about 100 miles and perhaps not even that well. You can see from that description that it gives us a significant enhancement in capability and fits very neatly into the scheme of maneuver which we would use.

Senator STEVENS. I should think it would also have a tremendous mission where we have forces that would be especially designated to try to restore airstrips and landing facilities for fixed-wing aircraft.

It can take a substantial number of people into places that have been fairly well damaged by our own attack and do that over fairly long distances. It has the legs that a helicopter will never have. That is, of course, why we are very much interested in the north country to see what the performance will be for the military.

Coming from a State that has 1,200 airports, if you can prove that this new system works, we are going to stop putting money into asphalt and cement and start using those for our major feeder transportation systems. It will have a tremendous civilian application if it works.

I want to assure you that it is one of the things that is high priority for us as far as your budget is concerned, too. I hope you will keep us informed if there is any possible difficulty that we can help you work on.

Senator Sasser.

Senator SASSER. Thank you, Mr. Chairman.

A-6 ATTACK CAPABILITY

I want to join in the chairman's request for a classified briefing on the Libyan operation. I think that would be very illuminating and very useful.

Admiral, as I understand it, the older A-6's at the present time have a light attack capability. Is that correct?

Admiral MARTIN. All of our A-6's, Mr. Sasser, have night capability.

Senator SASSER. The F-18's were scheduled to have night capability, were they not?

Admiral MARTIN. The F-18's presently have a limited night attack capability limited to reasonably good weather. It is a matter of degree of weather. We are looking into a whole host of means to enhance their night attack capability in less than optimum weather conditions.

VARIATION IN F-18/F-111 MISSION

Senator SASSER. Will we reach the point where the F-18's will have the capability to make a night attack operation in the sense that they could fulfill the same role at a later date that the F-111's did in the Libyan operation?

Admiral MARTIN. The F-18 is not designed for the same role and the same mission that the F-111 or the A-6, the current A-6, is. It is a different type mission. It is both an attack aircraft and it is a fighter aircraft. It will not have those systems which will allow for the extremely low level, right on the deck, in bad weather at night.

Now, it will have limited night attack capability. The night attack version of the F-18 will consist of an aircraft with a navigation FLIR—that is foward looking infrared system—raster HUD that gives a holographic type appearance on the heads-up display and also provides for a head down display.

The F/A-18 will have a good night capability, but it will not have the all-weather, low-level, long-range capability that either the A-6 or the F-111 presently has.

Senator SASSER. I have some erroneous information. I thought they were going to be modified to the point by 1988 they would have that capability.

Senator STEVENS. Which aircraft?

Senator SASSER. I am talking about the F-18.

Admiral WILKINSON. We are putting a night visual capability into the F/A-18 and the AV-8B, both. Also the A-6 will be getting that downstream. This will permit efficient operations at night, but not all weather like the A-6 and F-111.

Basically you will have night vision goggles, the cockpit lighting will be set so that you can see out well at night with those goggles and the equipment that Admiral Martin mentioned. They will be capable aircraft, but not like the long-range A-6's and F-111.

INCREASE IN NAVY AIRCRAFT BY 1991

Senator SASSER. Gentlemen, let me ask another question here that I am not sure you can answer. I am curious to see how you would respond to it, though.

In the first year of the Gramm-Rudman the Navy aircraft procurement account is strong in real terms. By the final year of Gramm-Rudman, in 1991 I see the Navy plans to increase the number of aircraft procured by 55 percent.

Now, how does the Navy realistically expect to achieve that goal in view of the budget trends of fewer dollars for defense?

Are you going to take it from someplace else in the Navy budget?

Admiral MARTIN. We are looking at trying to maintain, within the fiscal constraints that we have, a balanced and affordable program. Our budget that we are laying out for the 5-year defense plan is one that we think is achievable and is executable within the fiscal constraints that we have. But it is going to take a lot of moving and very careful management of our resources.

AGING OF AIRCRAFT FLEET

Senator **Sasser**. One of the problems that I think has been pointed out this morning with regard to naval aircraft is the aging of the aircraft fleet.

What happens to the air fleet if the Navy is not able to procure the number of planes it is requesting over the next 5 years?

Are you going to have to decrease the number of active squadrons?

Admiral **Martin**. We intend to exert every management effort possible to ensure that we can deploy a 15-carrier battle group and have sufficient squadrons to do that.

What we will have to do will be to reduce the number of aircraft we have in the pipeline, the length of time we will have to train people relative to the resources required to train them. But I hope we will be able to achieve the procurement that we have laid out.

Senator **Sasser**. Mr. Chairman, I have a number of other questions, but I think it might be more appropriate to propound these questions at the classified hearing.

Admiral, thank you.

Senator **Stevens**. Thank you very much.

Senator D'Amato.

Senator **D'Amato**. Thank you, Mr. Chairman.

Admiral, it is good to see you.

BEST AIRCRAFT FOR CARRIER SERVICE

Admiral, in light of your experience in fleet aviation jobs and now as the No. 1 naval aviator, if you could add one more aircraft to the decks of each aircraft carrier, which one would it be and why?

Admiral **Martin**. I am not so sure that every battle group commander would give the same answer to that question or would every fleet commander, but I think there might be a consensus.

Let me qualify the answer, first, Senator D'Amato, please.

There is only limited space on an aircraft carrier. The nominal number of airplanes that we put on a carrier that is operating at sea in a combat-type condition is somewhere between 80 and 100, depending on what types of aircraft they are and what their sizes are.

The high-technology world in which we live and in which we are evolving at a rapid rate demands close command, control, and communications capability. We want the capability to move outward from our forces and, therefore, command and control becomes very important.

In the final assessment, I, as a fleet commander or as a battle group commander, would probably opt to have another E-2C onboard. I think this is the general consensus of most because we do need to have that capability to ensure that we have the command and control and detection capability 100 percent of the time we are operating.

A-6E/A-6F PROGRAM

Senator D'AMATO. Let me ask you this. There has been a lot of publicity recently, the so-called memorandum of agreement between the Navy and the Air Force on the subject of the advanced technology aircraft and the advanced tactical fighter.

Since these programs are going forward, would you care to comment on the real requirement for continuation of the A–6E and A–6F?

Admiral MARTIN. The advanced technology programs under Air Force and Navy sponsorship are both in conceptual design phases at this point in time. We do not anticipate those will be in the fleet in any numbers until the latter part of the next decade, into the 21st century.

As I mentioned earlier, the A–6E and the follow-on A–6F will provide the only true, all-weather, low-level, long-range, deep-strike, interdiction capability in the next decade. It is a capability that we desperately need and events in the Mediterranean recently display that.

Therefore, we have a very real requirement for the A–6E and the A–6F into the next decade. The current A–6E and the follow-on A–6F, which is considerably updated in terms of engines, in terms of avionics, in terms of capability, is a remarkable airplane and it is nowhere like the A–6 that was designed in the 1950's. It is extraordinarily capable and we continue to find new uses for it and we indeed do need it into the next century.

Senator D'AMATO. Thank you very much, Admiral.

Mr. Chairman, I have no further questions, but I would like to join with you in that request for briefing. I think it would do the committee well. Certainly I would be most appreciative of an opportunity to attend.

PREPARED STATEMENT

I have a prepared statement to be made a part of the record. I request it be inserted at this point.

[The statement follows:]

PREPARED STATEMENT OF HON. ALFONSE D'AMATO, U.S. SENATOR FROM NEW YORK

Mr. Chairman, I thank today's witnesses for coming before this committee to discuss Navy aircraft procurement.

Mr. Chairman, over the past several months, Navy aircraft and pilots have had the opportunity to prove their reliability and effectiveness. The interception of the *Achille Lauro* hijackers last October, the exercise in the Gulf of Sidra last month, and the retaliation last week against the Libyan mainland showed our enemies and allies alike the strength, the courage, and the range of our naval forces.

I am particularly pleased with the performance of these aircraft that are made on Long Island: the A6–E, the F–14, the E–2C, and the EA–6B. These aircraft, along with other carrier aircraft, completed their missions outstandingly.

These successes were no accident. I have been impressed by the Navy's increased emphasis on sound business practices in contracting, acquisition, and systems improvements. Specifically, I want to highlight the increase in readiness of our Navy aircraft. The mission-capable rate for 1985 is over 70 percent and is expected to be even higher for 1986. This figure is more impressive when it is considered that the average age of Navy aircraft has increased to 12.6 years.

Improvements in today's aircraft, such as better engines and improved offensive and defensive weapons systems, are essential to the continued success of the Navy aircraft procurement program. This is important now and will remain important in the future because our adversaries are developing, or stealing, new technologies and weapon designs in an effort to neutralize our aircraft strike capability.

Even though I expect many cuts in the administration's fiscal year 1987 request for defense spending, I believe we must continue to improve our current operational aircraft, as well as continue to develop the advanced aircraft which will be needed in the 1990's.

Mr. Chairman, the events in the Mediterranean over the past several months clearly demonstrate the importance of our naval air power. I want to commend our witnesses today for the part they have played in the Navy aircraft procurement program, and I look forward to receiving their testimony.

Thank you, Mr. Chairman.

REQUEST FOR SUBCOMMITTEE QUESTIONS

Senator STEVENS. Senator Kasten had to go to replace the Presiding Officer in the Senate. He left a series of questions he would like to ask you to respond to. If you would do that, we would appreciate it. We do have a new concept that if any of those questions that require excessive manpower to answer, if you will let me know, perhaps we might resolve that question. He will get the answer he wants, I hope.

Senator STEVENS. Senator Cochran.

Senator COCHRAN. Thank you very much, Mr. Chairman.

Admiral Martin, welcome to the committee. General Smith, welcome.

MODIFICATION ON A-6E AIRCRAFT

In the supplemental appropriation for fiscal year 1985, there was money for some modification work on the A-6E aircraft. A significant part of the work was going to be performed in my State at Greenville, MS.

I am particularly interested in the status of that program and wonder how much of the $240 million that was included has been obligated and what the plans are for the A-6E modification program?

Admiral MARTIN. May I ask Admiral Wilkinson to address that, please?

Admiral WILKINSON. First of all, all of that money has been obligated. That was for the development and the procurement of the wings themselves. We expect to start installing wings in production aircraft and in the older aircraft in fiscal 1988. Some of those are currently scheduled to be done in Greenville.

Senator COCHRAN. Will there be an additional appropriation needed to actually pay for the installation of the wings?

Admiral WILKINSON. The installation will be in the operating and maintenance accounts. I think that it will be covered in our planning for fiscal 1988.

Senator COCHRAN. That is in the budget?

Admiral WILKINSON. Not in the 1987, but next year it will be.

Senator COCHRAN. But it is going to be in the 1988 budget?

Admiral WILKINSON. Yes.

COMPETITION AND DUAL SOURCING

Senator COCHRAN. The statement which you prepared for our hearing indicates that there is a major emphasis on competition and dual sources. In some of the documentation there is a reference to 5-year competitive multiyear procurement of F/A-18 aircraft beginning in fiscal year 1987.

Could you provide the committee with the status of this competition? Maybe you can tell us this morning?

Admiral WILKINSON. Yes, sir; I certainly can. The budget is currently set up for multiyear procurement for fiscal year 1988 to fiscal 1992 which would require advanced procurement funding for those fiscal years for that multiyear in fiscal 1987.

If we could achieve it, we would estimate a 10-percent savings over that 5-year period. The only problem we would have would be, is the program stable enough? We will certainly be looking into that. That is currently our plan.

Senator COCHRAN. There is $405.9 million identified for advanced procurement for this contract.

Can you tell us how much is associated with competition as opposed to sole source multiyear contract?

Admiral WILKINSON. I can provide for the record how much of it is required for the multiyear part. I do not really have a breakdown for the competitive aspect.

Senator COCHRAN. If you could provide that for the record, it would be appreciated.

Admiral WILKINSON. I will be happy to.

[The information follows:]

MULTIYEAR PROCUREMENT OF F/A-18

The fiscal year 1987 budget assumes a 5-year multiyear procurement of the F/A-18 commencing in fiscal year 1988. The advance procurement budget for fiscal year 1987 has been increased by $179.7 million to finance long lead material required for the multiyear effort.

F/A-18

Senator COCHRAN. Speaking of the F/A-18, last December Capt. Hank Kleeman, who I know Admiral Martin is familiar with as former 6th Fleet commander, was killed in an accident involving an F/A-18. Captain Kleeman was squadron commander and lead pilot when the two Libyan aircraft were shot down in 1981.

At the time there was discussion of a problem that existed with that aircraft which had caused several accidents. I wonder if this problem has been identified and what, if anything, has been done to correct it.

Admiral MARTIN. Let me lead off with that and then ask Admiral Wilkinson to elaborate, if I may, Senator.

First, the F/A-18 is enjoying probably the best accident rate for any major weapon system aircraft that has ever been introduced, certainly to my knowledge.

The attrition rate on the F/A-18 is less than one-half of what it was projected to be. All accidents are investigated thoroughly in order to determine what, if anything, is wrong with the aircraft and then they are fixed. The accident investigators work very closely with the Systems Command, which Admiral Wilkinson commands, in order to determine what did occur and how to fix it. To my knowledge, there is no commonality thus far in any of the significant F/A–18 accidents.

Hank Kleeman was a very close personal friend of mine and I have looked into that personally as well as I could. I am not certain that the real cause of that accident has been identified.

Admiral Wilkinson, can you elaborate on that?

Admiral WILKINSON. One of the things we found in that accident was a piece of the landing gear mechanism, called a planing link, had failed. We are not sure whether it failed before the accident or after the accident, but that particular part has caused us some problems in the past.

We have put in a fix for that and it has reduced the incidents of planing links from 13 to 1. We are still investigating that accident. We want to be sure that if a planing link failure does occur, the pilot is adequately warned of it.

There is a feature in the aircraft right now to so warn the pilot. We think we may need to improve that some.

Senator COCHRAN. Thank you very much.

V–22 OSPREY

General Smith, you talked about the V–22 Osprey in glowing terms to not be an overstatement. I note that the Defense Systems Acquisition Review Council approved the transition to full-scale development last Thursday.

In your statement you indicate that the engine contract was awarded to Allison for $76.4 million for the lease of 21 engines.

Could you give the committee some background on this approach to development? What would the Government have after it spends $2.5 billion on the development of the aircraft?

General SMITH. I realize, sir, the question is directed to me, but I would like to ask Admiral Wilkinson, as proprietor of that part of the shop, to answer for me.

Admiral WILKINSON. The leasing of engines is kind of a novel approach. We are only doing this for the development engines and the amount of money you are talking about, of course, is for the full development of the aircraft and the engines.

By leasing the development engines, we reduce the development cost significantly. We do not have to update those engines. They go back to the contractor and he can do whatever he wants to with them. I think it is a significant cost savings to us. We may try this with some other programs.

Senator COCHRAN. Thank you very much.

Thank you, Mr. Chairman.

Senator STEVENS. Thank you.

INCREASE IN F/A-18 AIRCRAFT LINE

General, we have sort of a general opinion that is reflected by some members of the committee and staff that it appears in this area you may be meeting the Gramm-Rudman cuts by cutting spares and support equipment rather than cutting procurement levels, reducing procurement levels to the extent that we should.

As a matter of fact, the F/A-18 is a good example. Last year we had advanced procurement for 84, for 1987, and now your request is for 120 aircraft. Not only is it ramping up for 1 year, but it appears you want a multiyear contract for 5 years to begin in 1988 at that level, that higher level of 120, notwithstanding the ongoing problems of meeting the budget restraints in this 5-year period.

Incidentally, we figure there will be 4 percent savings to go up to 120 aircraft, but the investment has to increase to $700 million. When you figure you are borrowing that money at 8 to 10 percent, there is no saving to have that procurement financed in advance that far.

Why do we have to have that 42-percent increase in this one aircraft procurement line?

REQUIREMENTS BALANCED AGAINST TOTAL AFFORDABILITY

Admiral MARTIN. Mr. Chairman, we derive our program and our plan predicated on our requirements, balanced against total affordability. We ramped up from the 84-buy last year to the 120 principally to put our emphasis on combat aircraft as opposed to our trainer and our support aircraft because they were needed and because we would like to phase out the A-7's in our program as early as possible.

The A-7 squadrons which the F-18 replaces are getting old, they are more difficult to maintain, and we would like to phase those out sooner in the program.

Now, 1 year ago when I was here our program showed a ramp up from 84 to 102. We revised this to 120 in this fiscal environment in order to realize the economy of scale and to phase the A-7's out earlier which would essentially end up in terminating the F-18 procurement at an earlier point in time.

We will continue to look at this as time goes on with our aviation plan in hopes that we can come up with the best economical situation versus requirements that we can.

Senator STEVENS. You are right, you asked for 102 last year, but Congress provided for advanced procurement of only 84. Now you are wanting 120 not only for 1987 but for the advanced procurement level, as I understand it, with 132 for 1988 and then building up to 163.

You have had fantastic savings at current level of procurement. As a matter of fact, I think in the past trend of purchasing you have done exceptionally well. The Secretary and those working with him deserve a great deal of credit for the savings in the current level of procurement.

SUCCESSOR TO A-6

Let me go into the background of this. It appears that you want a successor now to the A–6, too; is that right?

Admiral MARTIN. The successor to the A–6 which is a long, long way away is the advanced technology aircraft, which is just in conceptual design at this time. We are succeeding the A–6E with the A–6F, which is an upgrade to meet the threat.

Senator STEVENS. I understand that. But the F–18 cannot be considered successor to the A–6F.

Admiral MARTIN. The F–18 and A–6 complement each other. One will not replace the other in almost any mission.

Senator STEVENS. The F–18 does not have the legs that the A–6 successor has to have.

Admiral MARTIN. That is right.

Senator STEVENS. When you look at this from the point of view of the utilization of the F–18 and keeping in mind the scarcity of tankers onboard the carriers, we seriously question the decision which will apparently require the A–6 to be reconfigured as a tanker and end up by having in this interim period between the A–6 and its successor a shortened range of fighter aircraft of the first line.

I think if you ramp up to 120 and go up further to 163, you certainly have to put off the follow-on to the A–6.

Admiral MARTIN. Of course, the F/A–18 provides another role. It provides the fighter and attack role in the light attack mode that is the replacement of the A–7. You get a great synergistic effect by having the F/A–18 onboard in that when you are in a high-density fighter requirement, you have the F/A–18 which is a marvelous fighter and you also have it in the attack role.

We have yet to realize the full capability of this remarkable airplane. All of the battle group commanders are extremely pleased with it.

No, indeed, it is not designed to replace the A–6 in any fashion because that is a long-range, all-weather strike aircraft, not a fighter.

AIRCRAFT IN LIBYAN OPERATION

Senator STEVENS. It was conspicuously absent from the operation in Libya.

Admiral MARTIN. No, sir, it was not. The F–18 was used to great success in the operation in Libya in the fighter role. Also it launched the Harm missiles which did most of the damage to the Libyan radars.

I do not want to go further in this briefing.

Senator STEVENS. I will save that for the classified hearing briefing, but it was our judgment that the basic operations were A–6's and A–7's.

Admiral MARTIN. The ones across the beach were the A–6's. The A–7's, and I stand corrected, the F–18's did not launch the Harm, but the F–18's were used in the fighter role from the U.S.S. *Coral Sea.* The U.S.S. *America* did not have F–18's onboard.

Senator STEVENS. We will have a series of specific questions on this procurement. I would appreciate it if you would answer them just to make sure we have the record. I would hope we get those before we get to the classified hearing. I do not know how soon we will be able to do that, but we want to get that if we can before we get too far into May.

Admiral MARTIN. We will be pleased to answer them for the record.

A-6F AIRCRAFT

Senator STEVENS. You are going to begin the new A–6F production in 1988, is that right, but you still want to buy 11 A–6E's this year, in 1987.

Will they then have to be modified into A–6F's?

Admiral MARTIN. In shifting from one model of an aircraft to another, sir, there is always a phasedown and phaseup. You have to draw the line someplace.

The A–6E will be needed and we need those airplanes—they are very capable—until the A–6F comes on line. We do not anticipate retrofitting those particular aircraft into A–6F's.

As time goes on, we will look at a whole host of initiatives to modernize the older A–6's that we have. We very definitely need the A–6's we have in the program right now.

Senator STEVENS. Did Congress direct you to acquire 11 A–6E's in 1986 and 1987?

Five of them are to go to the Reserves, but it is our understanding that those aircraft will not be turned over to the Reserve squadron until 1990. If that is the case, the A–6F would be available in 1988–89 and could be turned over to them in 1990 just as easily.

It further appears that if you take these A–6E's off the line and put them back through the line for retrofitting, where is the economy if that is the case?

Admiral WILKINSON. We do not plan to retrofit those aircraft for an extensive period of time, if ever. Those will be our newest A–6E's. Those aircraft will also have the new composite wing. They will go in the fiscal 1987 aircraft.

It is important that we continue in production in 1987 so that we will have the wing already introduced in production, the wing going into aircraft will then be available for the A–6F in 1988.

Senator STEVENS. They will actually have the A–6F wing?

Admiral WILKINSON. That is correct. The same wing will be used to backfit older aircraft which have run out of their wing life.

COST OF A-6 IN 1989

Senator STEVENS. Would you tell us for the record what would be the additional cost if we slip production of the A–6 aircraft until 1989?

If you are going to produce these A–6E's for 1987, I do not know why you could not continue in 1988 and wait for testing of this new wing. I would like to know what the cost associated would be for delaying that A-6F production until 1989.

Admiral WILKINSON. We will be happy to provide that for the record, sir.

[The information follows:]

DELAY OF A-6F PRODUCTION

Delaying A-6F production until fiscal year 1989 would either necessitate buying another year of A-6E's or shutting down production for a year and incurring shutdown/startup costs in excess of $50 million. At the present time the new A-6 common wing is scheduled to complete qualification testing for flight 2 years before delivery of the first A-6F aircraft and 1 year before delivery of the first A-6E to be equipped with the new wings, and thus wing readiness for production should not be an issue in any A-6F production startup decision. However, deferral of A-6F production until 1989 would cost the Navy three very favorably priced production options for fiscal year 1988 through fiscal year 1990, that were negotiated as part of the fixed price development contract, and would place the A-6 significantly behind required force levels.

IMPACT OF SEQUESTRATION CUTS

Senator STEVENS. Can you tell us, Admiral Martin, what has now been the impact of the sequestration cuts as far as the 1986 procurement budget is concerned?

Admiral MARTIN. Sir, in fiscal year 1986 the impact will depend on the result of contract negotiations. It is clear that there will be some support equipment and spares deferred which likely will result in a lower aircraft readiness in the future.

Senator STEVENS. The V-22 was not covered by a multiyear contract, so it was not exempted from sequestration; is that right?

Admiral MARTIN. That is correct, sir.

Senator STEVENS. It did not have a fixed-price contract either.

Have you had to reduce any aircraft procurement quantities from the levels that we anticipated when we first passed this bill for 1986?

Admiral MARTIN. Not 1986, no, sir.

Senator STEVENS. Is it correct that the main effect of your sequestration action this year for 1986 has been on spares and support equipment?

Admiral MARTIN. May I ask one of the backup witnesses, Mr. Jim Darr of the Naval Air Systems Command to answer.

Mr. DARR. I am Jim Darr, Director of the Procurement Budget Division, Naval Air Systems Command.

We have not had to reduce the quantities of any aircraft this year in 1986, nor do we anticipate we will have to.

We do think there will be some reductions in the number of spares, modification kits, and support that we are able to buy this year. However, we think they are manageable in the same vein that the slippage of the training aircraft were manageable in putting together our budget submission.

We think that if we do not sustain any further reductions of this sort in future years, we will be able to manage the situation. We believe our budget has been structured in such a way that it will not require it.

Senator STEVENS. Thank you.

UNDERFUNDING OF PROCUREMENT PROGRAM

Let me ask you, Admiral, was not your procurement program underfunded from your point of view?

It was from ours. You had a reduction for 1986 to start with.

Admiral MARTIN. Yes, sir, from my point of view, it was underfunded.

Senator STEVENS. Could not you have met a portion of the sequestration by reducing slightly these procurement lines as opposed to the spares and support equipment?

Admiral MARTIN. We need those aircraft that are in the procurement line. There is a very real requirement for them.

It is also an economy of scale in terms of the number of aircraft in each line that we procure. We have reduced the number of aircraft that we wanted from 329 to 271. I would not want to go lower than that number in the interest of what we need to outfit our Navy to meet those requirements that we face.

Senator STEVENS. You have six major aircraft development programs that total more than $1 billion in fixed-price contracts now. Your document says that these programs "should not be disrupted by actions that would require DON renegotiations to be reopened and which would invalidate current cost advantages."

Is that saying that simply there is no way that we can reduce the R&D funding for those programs without forcing contract negotiations?

Admiral MARTIN. That is correct, sir, in the firm fixed-price contracts.

Would you like to elaborate on that, please, Admiral Wilkinson?

Admiral WILKINSON. That is correct, sir. The funds, of course, include other than the prime contract, but the prime contract comprises the majority of the funding for each of those programs. If we do not provide the money, we break the agreement. It would have to be renegotiated at a higher price.

Senator STEVENS. The question I am raising is that you now have a substantial portion of your contracts under fixed price, F–14D, A–6T, T–45TS, AV–8B, the E-6A, and the V–22. That leaves others subject to rather severe reduction in the event you have large budget reductions, does it not?

Admiral MARTIN. Yes, sir, it does. We have saved an enormous amount of money by firm fixed-price contracting. As I mentioned in my opening remarks, I believe that we should develop certain modalities that would consider these savings and affirm the fixed-price contracting system and even to the extent of totally exempting them, because if we do have to break those contracts and renegotiate them, the price will be severe.

Senator STEVENS. If you added F–18's to them, the 120 level going up to 163, and we continue to have these budget crises, something is going to give. In the final analysis it will have to be spare parts under the existing circumstances. That would be shooting yourself in the foot, in my opinion.

I think there ought to be some consideration given to having a firm fixed-price contract with a range of production options rather than fixed price at a stated level of production, which gives you no flexibility at all. It is something you will have to take a look at.

It is your intention, is it not, to put the F–18 into a multiyear contract, fixed price commencing in 1988?

Admiral WILKINSON. That is the way our budget is currently structured, yes, sir.

Senator STEVENS. I just think somehow or other we have to take a good look at those items.

NIGHT ATTACK UPGRADE OF AV–8B AND F/A–18

Let me go to one other thing here and that is this whole subject of the effectiveness of your R&D program for the AV–8B and F/A–18 on the night attack upgrade.

Do you know how much that upgrade would add to the unit cost of those two aircraft?

Admiral MARTIN. The unit cost for the F/A–18 night attack upgrade will be $272,000 per unit.

Senator STEVENS. Per unit?

Admiral MARTIN. Yes, sir.

Senator STEVENS. Will these upgrades be incorporated into the production line after 1987?

Is it just on the past production, production up to 1987 that we are talking about this upgrade?

Admiral MARTIN. Fiscal 1988 is when it will be incorporated into the production line. It will be a forward fit from that point on.

Senator STEVENS. It appears that there has been some sort of limitation placed on the United States portion that is a joint United States-United Kingdom program.

Could you explain that to us? If it is cost effective, why should there be a cap placed on that portion of the program?

Admiral WILKINSON. That is the kind of discipline we have been using within the Navy to keep our programs within bounds and also to eliminate the goldplating on what we are buying. That is the cap that we have set, ourselves, within the Navy.

The United Kingdom has contributed some money. We have contributed the rest. I think it is a pretty good system actually. It really makes our engineers look at the specs very carefully. It makes us understand exactly what we are buying, both the contractor and the Navy. It has been a good process.

Senator STEVENS. As I understand this one, it will give night capability to these two systems, is that sufficient for them to really have a total all-weather capability and night attack capability?

Admiral WILKINSON. It gives them a night visual attack capability, not all weather. They will use night vision goggles. They will be able to see better at night, have forward looking infrared receivers so that they can tell where they are going, and navigation systems so that they can navigate at night, not like the A–6 or the F–111.

Senator STEVENS. They will not have an all-weather capability; is that right?

Admiral WILKINSON. Not in the context of the A-6 and F-111.

Admiral MARTIN. I would like to call that an austere capability.

Senator STEVENS. That is the word my staff used, austere capability.

Admiral MARTIN. Austere capability in the interest of affordability and also what you can physically put in an aircraft of that size.

P-3D UPGRADE

Senator STEVENS. Do you propose to close down the P-3C production line after the 1988 buy and go to upgraded P-3D?

Admiral MARTIN. Our current plan is to compete the P-3D in fiscal year 1987 and open the line in fiscal year 1989 for a total buy of about 125 aircraft through fiscal year 1994. The P3-D will have a new engine, improved range, and considerably greater survivability features as compared to the P-3C and the cost will be comparable. We intend to compete the P-3D.

Senator STEVENS. The P-3D will incorporate some modifications to the engine, additional survivability features, and increased reliability, maintainability improvements, so really the question is whether we really need the nine P-3C's in 1987 if you are going to go to this improved program in 1989.

Admiral MARTIN. It is going to take a period of time for the new program. Again, you have to stop somewhere and start someplace. That is the reason we are starting those for the P-3D line to be opened in 1989 and we will compete that aircraft. We hope to have that contract by next summer.

The P-3D will essentially be the P-3C with new engines and the update for the avionics package.

RETROFIT ON P-3C

Senator STEVENS. Will there be a retrofit on these P-3C's?

Admiral MARTIN. The nine P-3Cs will have the update three package in it and we do not anticipate retrofitting those C's into the D model. It is just a matter of where you stop one and start the other.

Senator STEVENS. It seems we are proposing a substantial ramp up in production. The line is about nine now. By 1990 it will go to 25 and then go from 29 up to 32 in your projections on the P-3's.

I want to give you all the support I can, but on every one of these lines I see projections that go out with increased procurement. I do not think it is realistic in view of the downward trend of the defense budget in this period. Are you planning to have another fixed-price contract on that one, too?

Admiral MARTIN. That will be a competed program. We intend to ramp up and buy the 125 airplanes in about a 6-year period of time. We think that will be the most economical way to do that and it will be a buyout.

Senator STEVENS. I hope everybody takes a long look at the numbers involved. I cannot contemplate that kind of increase in this budget in terms of aircraft procurement at a time when I project that the defense budget is going to be roughly planing if we are lucky.

Are you not at about 95 percent of your projected level of P-3 requirements right now?

Admiral MARTIN. I would have to provide that for the record, sir, because we have a sliding scale on these requirements and we are also trying to put the P-3C's into the Reserves because they are providing a very real antisubmarine warfare capability.

The threat with the Soviet third and fourth generation submarines coming on is considerably greater. We need the P-3C with the update four or the P-3D to meet this threat. In terms of whether we are at 95 percent of the requirement at this point in time or will be the next year or following year, I have to provide that for the record.

[The information follows:]

P-3C REQUIREMENT

Today's P-3C inventory is only about [deleted] of the total Active Force requirement and [deleted] of the combined Active and Reserve Force requirement. While new P-3C procurement through fiscal year 1988 permits 22 of the 24 Active squadrons to complete P-3C transition, the VP force is currently operating without a pipeline and the fleet replacement squadrons [FRS] are operating without a full complement of P-3C's. The current inventory for P-3C's is deficient by approximately [deleted] aircraft and based on planned P-3D procurement, the [deleted] of force requirements will be achieved in [deleted].

RETIREMENT OF CERTAIN AIRCRAFT

Senator STEVENS. We do not get to the Secretary of Defense now until the last, rather than first, in our procedure. I will have to ask him to project what the level of budget, absolute minimum budget levels would be for the period of 1989–94 with these expanded levels of aircraft and the increased requirement for pilots and support personnel.

It looks to me like the ramping up of production is going to put a tremendous strain on pilot requirements, on maintenance requirements, on maybe even carrier capability to handle the aircraft.

Admiral MARTIN. Many of these aircraft we are ramping up in production are to replace aircraft that will be ending their service life. We are not increasing our total overall inventory in the Navy in terms of aircraft significantly.

We will end up having a sufficient number of aircraft to outfit 15 carrier battle groups with 14 active air wings. We will have three Marine air wings and we will have two Reserve air wings.

The numbers of aircraft involved with this is not significantly changed. We are not ramping up in terms of the total number in the inventory. We have many aircraft we bought back in the 1950's and 1960's that are reaching the end of their service life. These will be retired.

One of the things we must be careful of is that we do not allow these aircraft to increase in age to the point where they are unsafe and unsupportable.

Senator STEVENS. I understand that. But the numbers we are looking at now look to me like a substantial ramping up of naval aircraft procurement. We will go into that later.

I am sure Senator Proxmire has some questions.

Senator PROXMIRE. Thank you, Mr. Chairman.

I would like to follow up what the chairman has been asking about.

DEFENSE ACQUISITION POLICIES

There was a recent study of defense acquisition policies by a number of former defense officials including Adam Yarmolinsky, Admiral Davies, Lawrence Korb, and Stanley Resor. They indicated that the defense procurement, not just the Navy, but defense procurement overall, was so substantial that they saw us moving from a 20-year replacement cycle to a 10-year replacement cycle.

They said we are in danger of developing what they called a hollow force. We would have all kinds of equipment, but we would not have the personnel for operation and maintenance overall.

The chairman was asking specific questions. I am asking the general question overall. As you look at the defense acquisitions, not only in the Navy, but elsewhere, is that not a stinger?

Admiral MARTIN. I can only speak for naval aviation and from overall experience in the other areas. I think we are looking very carefully to see what we need as requirements in an austere environment with respect to those personnel required to fulfill our forces. I think the total picture is reasonably well balanced.

We will continue to try to refine that balance. I do not see developing hollow forces.

Senator PROXMIRE. Because we have to look at it, especially we in the Appropriations Committee have to look at what we can fund, how much will be available for funding defense?

There has been some general consensus that we should have no increase in 1987 except for inflation and maybe a 3-percent increase, maybe none.

This group I just mentioned here proposes for 5 years we have the same level of funding for the Defense Department except allowing for inflation during this 5-year period. They claim our conventional forces could be strengthened if we are selective and careful about it and we would still have an adequate retaliatory deterrence with this kind of combination.

I realize you are testifying this morning and you are a specialist and expert in naval aviation, but you also have the kind of judgment we can rely on for an overall picture, too.

FORCE MANNING

Supposing you are constrained in something like I have described and we go ahead with their procurement, will you have a situation where you will not have the maintenance personnel and operations personnel to do the job?

Admiral MARTIN. Senator, I think we watch very carefully to ensure that we have the ability to man our forces.

I would also suggest in the overall that we must be very careful with respect to our defense posture, with respect to the threat and the projected threat in the out-years, that we must ask ourselves what price are we willing to pay for freedom and what level of defenses must we have to ensure that we can deter aggression and adventurism, and if that deterrence should fail, that we can prevail in time of conflict.

We must structure our forces to that level, considering affordability and the ability to plan our forces.

V-22 OSPREY

Senator PROXMIRE. I notice that the Defense System Acquisition Review Council has approved the Navy's plan to begin development of the Navy V–22 Osprey program which is a tilt rotor aircraft to transport personnel and equipment. I realize that represents a revolutionary design and be able to take off and land as a helicopter.

Could not the mission you plan for the V–22 be performed by other aircraft we already have in the inventory?

It would be a nice plan to have, but in the era of Gramm-Rudman, is this a luxury we cannot afford?

GAO estimates we could save $396 million in 1987 and $4.9 billion in the next 5 years if we canceled the V–22 and relied on airplanes and helicopters currently in stock to perform the same mission.

Admiral MARTIN. I will unequivocally state that the requirement for the V–22 is one of our most profound requirements we have in the service today to support the Marine lift requirement.

I would like to ask General Smith to elaborate on that, but before that, the V–22 has now been selected to replace the S–3 as our center zone antisubmarine warfare carrier-based aircraft.

It also will be used by the Air Force and the Army in the Special Operations Forces mission. It has an enormous capability. It is going to revolutionize aviation.

That is an exciting program with an extraordinary promise. Insofar as the Marine requirement, which is the core requirement, I would like to ask General Smith to elaborate on that, if I may.

General SMITH. The V–22, as you know, replaces the CH–46E for our primary assault support transport airplane. The CH–46E is incapable of lifting some of the equipment that is coming in with the ground force modernization program. So, it is not adequate to perform the mission as that growth occurs.

The V–22 offers us, in addition to lifting capability, speed, range, and manueverability and a distinct advantage over existing helicopters. In that case those three factors are equal to life, success on the battlefield.

I indicated previously that the V–22, CH–53E, and landing craft aircushion vehicle standing 200 miles off the coastline expands the threat to the enemy to 700 miles. That presents to them an equation they cannot solve in constant defense of the coastline.

The matter of cost is probably as widely disagreed upon as any subject in Washington today. The studies that we have performed indicate that there are no off-the-shelf alternative aircraft that can perform the mission. That means if we take some other aircraft, we will have to upgrade it to make it capable of performing the mission that our V-22 is designed for.

In our estimation, that makes the V-22 the most cost effective preferred alternative.

JOINT USE OF AIRCRAFT

Senator PROXMIRE. Let me ask two questions on one other subject.

Admiral Martin, I was pleased to see the memorandum of understanding the Navy and the Air Force signed last month pledging each service to utilize the other's next generation aircraft—that is, the Navy's proposed advanced tactical aircraft and the Air Force's proposed advanced tactical fighter.

DOD officials have said this could save billions of dollars compared to the cost of developing separate planes. I have two questions.

As a result of this memorandum of understanding, can Congress expect to see one advanced tactical aircraft being produced for both services, keeping in mind that each service would have to modify the plane to its own needs?

Admiral MARTIN. The memorandum of understanding was relative to the Navy use and participation in the advanced technology fighter that the Air Force is the principal service; on the other hand, for the Air Force to be involved in and use a variant of the advanced technology aircraft of which the Navy is the principal service.

I think it is too early to say exactly what deviations from the basic aircraft of each respective service would be necessary for use by the other. But we want to ensure that we have Navy requirements incorporated in the advanced technology fighter. And the Air Force wants to ensure that they have their force peculiar requirement incorporated in the advanced technology aircraft.

We will proceed in this way. Both of those aircraft are in conceptual design. I cannot say at this point in time to what degree there will be commonality in those derivatives, but we are going to work toward a maximum commonality and maximum utilization of the other service's product.

REDUCTION OF SERVICE AIR FORCES

Senator PROXMIRE. Let me ask if this understanding can be pushed a lot further? Could this memorandum of understanding lead to less overlap of the air superiority close air support and deep strike missions both services seem to be pursuing?

In other words, the Department of Defense presently has four separate air forces. We first have the Air Force. Then the Navy has its own air force. The Marine Corps has its own air force. And the Army has its own air force, which consists of a huge helicopter fleet.

Is there any chance this memorandum of understanding might represent a glimmer of hope that we can get rid of some of this duplication of missions?

Admiral MARTIN. I think all of the services are taking every possible step to ensure the maximum commonality of weapon systems between the services that is possible.

Yes; I think this type of memorandum of understanding would be most useful in future programs. But right now it is not just in terms of the basic weapon system in airplanes, but also in component parts.

We have an enormous amount of commonality with the Air Force and with the Army. The Army, for example, procures all of our bombs for us, what we call dumb bombs or level-of-effort bombs. They buy, procure, and manage all the bombs. We are taking every step possible to ensure maximum commonality between the services.

The V–22 is a classic example of this. We envision the V–22 being used by all of the services with the basic Marine design being the baseline. I would hope that we will continue to do this in the future. It is the only way we will be able to afford a large procurement.

Senator PROXMIRE. I appreciate that very much. I hope you can push it as hard and as far as you possible can. I realize there is understandable pride in each of the services and that is a fine thing.

In view of the fact we are living in the age of Gramm-Rudman and very strict budget limitations, I would hope you can find a way of making these as common as possible.

Admiral MARTIN. I might also add between the Air Force and the Navy there is not a duplication of missions. These missions complement each other. In terms of all our procurement, Senator Proxmire, joint programs, commonality is a by-word in our acquisition process right now.

Senator PROXMIRE. Thank you, Mr. Chairman.

Senator STEVENS. Thank you very much.

SUBMITTED QUESTIONS

The committee has additional questions for the record which will be inserted at this point.

[The following questions were not asked at the hearing, but were submitted to the Department for response subsequent to the hearing:]

QUESTIONS SUBMITTED BY SENATOR STEVENS

Aircraft Spares and Repair Parts

QUESTION: I notice that you are requesting $1.8 billion for aircraft spares and repair parts, a 55% increase over the 1986 funding level, after Gramm-Rudman cuts. Why do we need this large increase of over $650 million in the 1987 level of funding?

ANSWER: The FY-86 funding had only one-half year of outfittings and FY-87 has a full year. This was caused by the stock funding of outfittings from 1 April 1985 to 1 April 1986 as part of the AVDLR (Aviation Depot Level Repair parts) test. The FY-87 request of $1.8 billion is in line with the $1.939 billion requested for FY-84, last full year of outfittings.

QUESTION: In previous years, there were reports of shortages of aircraft spare parts on deployed aircraft carriers. What is the current status of aircraft spare parts on deployed aircraft carriers?

ANSWER: The following information is provided for four recent deployers:

		AVCAL %		*ROTATABLE POOL	
SHIPS	DEPLOYMENT DATE	RANGE	DEPTH	RANGE	DEPTH
SARATOGA	8/28/85	(Deleted)	(Deleted)	(Deleted)	(Deleted)
CORAL SEA	10/1/85	(Deleted)	(Deleted)	(Deleted)	(Deleted)
ENTERPRISE	1/19/86	(Deleted)	(Deleted)	(Deleted)	(Deleted)
AMERICA	3/25/86	(Deleted)	(Deleted)	(Deleted)	(Deleted)
D MINUS 60		(Deleted)	(Deleted)	(Deleted)	(Deleted)
D MINUS 30		(Deleted)	(Deleted)	(Deleted)	(Deleted)
UPON DEPLOYMENT **		(Deleted)	(Deleted)	(Deleted)	(Deleted)

NOTES:

* Rotatable pool consists of high usage repair parts that can be repaired aboard the ship.

** Statistics are much better than previously, reflecting the continuing Congressional support.

QUESTIONS SUBMITTED BY SENATOR KASTEN

SH-2F HELICOPTER PROCUREMENT

QUESTION: This year's budget requested six SH-2F helicopters which I am told are for the Reserves and for which I am sure you have a requirement--correct?

ANSWER: The six SH-2F's requested in the FY-1987 budget will provide aircraft required by the Reserve forces to support eight FF-1052's, 18 FFG-7's and 12 Coast Guard WHEC 378 class ships.

QUESTION: Are there additional requirements beyond these six and can we expect the Navy to come forward next year with a complete program to address these needs?

ANSWER: The FY-1987 budget request for six aircraft will meet the LAMPS MK I total force requirement for years FY-1989 through FY-1994. However, projection of historical SH-2F attrition rates combined with a programmed extension of some LAMPS MK I capable ships' service life through the year FY-2000 will cause a manageable shortfall of assets in the FY-1985 to FY-2000 timeframe. After FY-2000, there are sufficient assets to meet the requirement due to rapid retirement of FF-1052 and FF-1040 class ships.

QUESTIONS SUBMITTED BY SENATOR D'AMATO

RESERVE AVIATION

Question: General Smith, in an effort to modernize Reserve Aviation, you state that a second 12 Aircraft Aerial Refueler Squadron is to be formed at Stewart Airbase in N. Y. Exactly when do you expect this squadron to be placed at Stewart?

Answer: "Our intention is to form a second Reserve 12 KC-130 aircraft Aerial Refueling Squadron at Stewart Airbase in N. Y. during FY-88."

QUESTIONS SUBMITTED BY SENATOR STENNIS

F/A-18 PROCUREMENT

QUESTION: I notice that, in 1987, you are buying 18 more F/A-18 aircraft than you planned a year ago for 1987. I also notice that you are now planning to buy 57 more F/A-18 during the 1987-1990 period and 9 fewer F-14 and 22 fewer AV-8B aircraft during the same period.

What is the reason for these changes in your plans? You appear to be shifting funding from the F-14 and AV-8B to the F/A-18.

ANSWER: The FY 1987 aircraft procurement request is a balance between our requirements and what is affordable. The increased numbers of F/A-18s requested are the result of our efforts to procure these front line aircraft at the most economic rate possible and to replace our aging A-7 attack aircraft with the F/A-18 and its advanced technology and exceptional reliability as soon as it is economically feasible. The more economic production rate of 120 A/C is expected to save $1.5 million per aircraft when compared to a rate of 84 per year.

The F-14 and AV-8 programs have been restructured somewhat; however, the inventory objectives for our Carrier air wings and Marine air wings remain firm and will be achieved on schedule.

SUBCOMMITTEE RECESS

Senator STEVENS. Our next committee hearing will be on Tuesday, April 29. We will have the testimony by nongovernmental witnesses on the whole budget.

[Whereupon, at 11:50 a.m., Wednesday, April 23, the subcommittee was recessed, to reconvene Tuesday, April 29, 1986.]

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1987

THURSDAY, MAY 8, 1986

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 10:05 a.m., in room SD–192, Dirksen Senate Office Building, Hon. Ted Stevens (chairman) presiding.

Present: Senators Stevens, McClure, Kasten, D'Amato, Proxmire, Chiles, Johnston, Stennis, and Sasser.

DEPARTMENT OF DEFENSE

DEPARTMENT OF THE NAVY

STATEMENTS OF:

HON. MELVYN R. PAISLEY, ASSISTANT SECRETARY OF THE NAVY (RESEARCH, ENGINEERING AND SYSTEMS)

REAR ADM. KENNETH C. MILEY, U.S. NAVY, DIRECTOR, STRATEGIC SYSTEMS PROGRAMS, DEPARTMENT OF THE NAVY

CAPT. JOHN M. HULING, U.S. NAVY, HEAD, NUCLEAR NEGOTIATIONS BRANCH, STRATEGIC AND THEATER NUCLEAR WARFARE DIVISION, OFFICE OF THE CHIEF OF NAVAL OPERATIONS

STRATEGIC PROGRAMS

BUDGET REQUEST

Senator STEVENS. Good morning.

The subject of today's hearing is the fiscal year 1987 budget request for Navy and Air Force strategic programs.

The fiscal year 1987 defense budget includes $25.4 billion for strategic procurement programs. The largest portions of the request are $1.4 billion for the procurement of the first 21 Trident II ballistic missiles and $1.4 billion for 21 MX Peacekeeper test missiles.

In addition, the Air Force requests $1.4 billion for R&D to take the small ICBM into full-scale development, and the Navy seeks $1.6 billion to continue development and initiate flight testing on the Trident II.

Funding for classified programs will not be addressed in this open hearing.

INTRODUCTION OF WITNESSES

Our witnesses today are the Honorable Melvyn R. Paisley, Assistant Secretary of the Navy for Research, Engineering, and Systems; Vice Adm. Albert J. Baciocco, Jr., USN, Director, Research, Development, and Acquisition; Dr. Thomas E. Cooper, Assistant Secretary of the Air Force for Research, Development, and Logistics, and Lt. Gen. Bernard Randolph, Deputy Chief of Staff of the Air Force for Research, Development, and Acquisition.

Gentlemen, we will put your complete written statements into the record. We would ask you to summarize them briefly in your opening remarks and then we will proceed with questions and answers.

We will start with the Navy.

Secretary Paisley, please proceed.

STATEMENT OF MELVYN PAISLEY

Mr. PAISLEY. I just want to make a couple comments. I am sure Tom will also want to and then I will be ready to go into the question period.

It is a pleasure to be over here. I brought a number of my key people with me. The reason I have done this is that I would like to be able to answer all your questions without taking anything for the record unless you desire it. I would not like to delay getting answers to you. I think we are capable of doing that if we stay within the field of the people who are here.

It is good to be here with Tom Cooper. We work together in the building a lot. There is a funny myth that runs around that the services do not work together. I think a lot of activities that have taken place in recent weeks show our ability to function closely together.

We have our own biases that cause us to argue a lot on joint programs. However, I think in sum we have had a very successful period in the last 4 or 5 years.

Dr. COOPER. I agree with you.

Mr. PAISLEY. With that, I have completed my remarks. I have also submitted a statement for the record.

Maybe Admiral Baciocco would like to say a word.

Admiral BACIOCCO. No, not at this time. I do, however, have a prepared statement for the record.

[The statements of Mr. Paisley and Vice Admiral Baciocco follow:]

PREPARED STATEMENT OF MELVYN R. PAISLEY

ASSISTANT SECRETARY OF THE NAVY

RESEARCH, ENGINEERING AND SYSTEMS

INTRODUCTION

Our Navy is significantly better equipped and prepared for sustained operations today as a result of our five-year effort to strengthen our national security. The FY 1987 budget request of $10.6B for Navy Research, Development, Test and Evaluation is aimed at maintaining this strengthening process by turning technological and management initiatives into genuine force modernization achievements. The effects of our RDT&E program are being realized everyday as new and improved systems enter the fleet. These systems allow our naval forces to perform to their fullest potential in preparing to meet any enemy threat. We believe that by maintaining our technological superiority we can partially offset the numerical superiority of the Soviet Union's forces and those of their allies.

The Navy's RDT&E program is molded to the requirements of our maritime strategy. The SECNAV clearly described our nation's maritime strategy as follows "...to prevent the seas from becoming a hostile medium of attack against the U.S. and its allies, and to ensure that we will continue to have unimpeded use of the world's oceans for trade and commerce as well as reinforcement and resupply of our forces in peace and war." We are accomplishing this through the use of management initiatives; by getting control over design changes as well as reducing the number of programs (from 551 in FY 1981 to 395 today); and cancelling certain development programs where payoff in capability and efficiency has been marginal. The result is that we have been able to redirect our efforts to those essential programs which allow us to support our maritime strategy to the fullest.

Of particular interest today are our strategic programs which comprise about $2.0B or 19% of our total RDT&E effort. I would now like to report on the Navy's R&D in strategic programs.

The Navy's Strategic Missile Submarines form one leg of our nation's strategic triad providing a retaliatory capability which is survivable and enduring. Our Poseidon and TRIDENT submarines are invulnerable to a Soviet pre-emptive attack and they can remain on patrol for more than two months without external support.

This past year was the twenty-fifth anniversary of the Fleet Ballistic Missile (FBM) Force. During this period the FBM force has completed 2413 successful deterrent patrols. To meet the changing threat, and to cover a broader spectrum of targets, the force has been progressively modernized from Polaris to Poseidon to TRIDENT I. Today our 30 Poseidon and seven TRIDENT Strategic Ballistic Submarines carry approximately 50 percent of our nation's strategic nuclear weapons. The combination of survivability and endurance ensures that the retaliatory capability of these forces is credible to our adversaries.

The Navy has accepted seven TRIDENT SSBN's, six of which are operational and conducting deterrent patrols with the C-4 Missile. There are thirty Poseidon SSBN's, twelve of which carry the C-4 Missile.

Poseidon submarines are an important and effective part of today's deterrent force. They will, however, reach the end of their service life by the end of the century. Arms control considerations may mandate an even earlier retirement of these Poseidon submarines than service life considerations would require.

The Navy's initiatives to improve strategic weapon accuracy and yield have been necessitated by Soviet efforts in the last few years to increasingly harden installations which protect their leadership and their warfighting installations. To counter an ever increasingly hardened target requires weapon accuracy as well as an adequate explosive force. To achieve the appropriate balance between these two key parameters, the Navy initiated an SLBM accuracy improvement program in the mid-seventies. We looked at all the parameters which degrade system effectiveness. The intent of this program was to quantify the needed improvement if a SLBM was to engage hardened Soviet targets. The results of this study provided the basis for the TRIDENT II program now entering the third year of engineering development. The TRIDENT II program, scheduled for IOC in 1989, has both the accuracy and yield to engage the full spectrum of Soviet hardened targets.

As we reported previously, the first TRIDENT II weapon system will go onto the ninth TRIDENT submarine. This has been, and remains, a challenge since this originally was to be a TRIDENT I ship and construction had already begun. I am happy to say that so far we have met all scheduled weapon system component deliveries and all critical interface design requirements.

The Navy also pursues a vigorous SSBN security program to ensure that our submarines remain survivable in the face of ever improving Soviet technology. This program reviews on a continuing basis those technologies which potentially could degrade our submarine survivability and then looks for solutions.

In addition, reliable command and control of strategic forces is essential to deterrence. Reliability of communication with our SSBN force is achieved through redundancy. This multiplicity of methods and geographic dispersion of assets provides continuous, reliable and survivable communications with our SSBNs. Our submarines can receive very low frequency, low frequency, high frequency and ultra high frequency messages from numerous shore based, shipboard, satellites and TACAMO aircraft transmitters. A significant near-term addition to the communications capability is the Extremely Low Frequency (ELF) transmission system which has recently completed operational testing in Wisconsin. The first phase of this system should become operational in late FY 1986. A second transmitting site is being constructed in Michigan and is expected to complete operational testing in the fall of 1987. Full operational capability of the ELF system will be achieved in FY 1988.

We also will be able to receive messages from the Military Strategic Tactical and Relay (MILSTAR) satellite when it achieves its IOC in the early 1990s. To maintain and improve the current connectivity, we are in the process of replacing our older EC-130 TACAMO aircraft with more capable E-6A aircraft. This program is going well and production of the prototype aircraft commenced last year. Procurement authority for the first two of 14 production aircraft was included in the FY 1986 appropriation. Three aircraft are included in the FY 1987 budget request. The communications suite for the E-6A will come from the EC-130 TACAMO aircraft.

To add to deterrence and to increase our conventional strike capability the Navy has deployed the TOMAHAWK weapon system on eight surface ships and fourteen submarines. The ultimate deployment will be on most attack submarines, destroyers, cruisers and battleships. The addition of this weapon system provides the national command authority with a more flexible and survivable reserve force.

During the past year we completed the Operational Evaluation and authorized production of the conventional variant of the TOMAHAWK system. The submunition dispenser variant is now in development test and will begin OPEVAL in FY 1987.

The procurement strategy used with TOMAHAWK is competitive dual source procurement of both missile production and depot maintenance. This is our first year of complete competitive procurement and the results achieved as measured by savings to the government are most encouraging.

Based on a successful development testing, and to meet shipfill requirements, limited production of the 688 Class Vertical Launch System (VLS) was initiated. We have demonstrated successful development testing of TOMAHAWK vertical launch capability from our underwater submarine launch simulator, a submarine, as well as from the USS NORTON SOUND. Operational evaluation of our surface ship VLS system is currently in progress with an initial operational capability expected in FY 1987.

The Navy fully supports the President's Strategic Defense Initiative. We are providing support, through our laboratories, in basic technology research. Most of the Navy participation has supported directed energy technology with the largest single effort an outgrowth of the Navy's High Energy Laser Program. This joint service effort, under Navy program management, uses the most powerful research laser in the free world. It is in the forefront of solving a wide range of basic technical problems relevant to High Energy Laser systems and is particularly important to the development of the optics and beam director portions of SDI's Free Electronic Laser Program.

The Navy is also making important contributions to SDI in the area of Battle Management (BM)/C^3. Our contributions are a natural extension of our prior experience in the area of multilayered defenses for carrier battle groups.

Over the last quarter century, the Navy has made contributions to strategic deterrence which are survivable, enduring and are being modernized progressively. Technologies from current Navy research programs are also making viable contributions to our nation's Strategic Defense Initiatives.

MELVYN R. PAISLEY

BIOGRAPHY

Mr. Melvyn R. Paisley was nominated as the Assistant Secretary of the Navy (Research, Engineering, and Systems) by the President on October 27, 1981, approved by the Senate on November 23, 1981, and took the oath of office on December 2, 1981.

A native of Portland, Oregon, Mr. Paisley graduated from the American Institute of Technology in 1953 and completed his graduate work at MIT in 1954. As a fighter pilot with the Air Force during World War II, he is credited with shooting down nine enemy aircraft, and was awarded the Distinguished Service Cross, the Silver Medal with one Cluster, the Distinguished Flying Cross, and 16 Air Medals.

Mr. Paisley comes to the Department of the Navy after 28 years of military business experience with the Boeing Company. At Boeing, Mr. Paisley was involved in all phases of airplane, missile, and electronic development.

Prior to Mr. Paisley's retirement from Boeing in 1981, he was Vice President of Boeing International Corporation and International Plans and Operations Manager for Boeing Aerospace Company. He structured Boeing Aerospace Company's first international military sales organization and was responsible for what is now the NATO AWACS (E-3A) Program.

On special assignment to the Defense Science Board in 1978, Mr. Paisley led the industry team which was instrumental in developing the memoranda of understanding for the family of weapons concept in that year. His appointment to this assignment was based on his understanding of NATO military requirements, and his established relationship with the NATO military community, industrialists, and Parliamentarians.

In his present capacity, Mr. Paisley is responsible for all matters related to research, development, engineering, and test evaluation within the Department of Navy, as well as for technology transfer, oceanography and ocean engineering. His responsibilities include the management of the appropriation "Research, Development, Test and Evaluation, Navy," giving him far more control over the Navy's R&D programs than normally exercised by officials at the Secretarial level. As the Navy Acquisition Executive (NAE), Mr. Paisley is the principal advisor to the Secretary of the Navy for development of Navy systems and equipment.

Mr. Paisley is married to the former Vicki McKim. He has four children.

PREPARED STATEMENT OF VICE ADM. ALBERT J. BACIOCCO, JR. DIRECTOR, RESEARCH, DEVELOPMENT AND ACQUISITION

STRATEGIC PROGRAMS

Navy strategic programs are focused on expanding the effectiveness, survivability, connectivity of the sea-based leg of our nations Strategic TRIAD. Of the Navy's overall budget request for FY 1987 which totals $10.6B or about 10.2% of Navy TOA ($103.5B), approximately $2.0B or 19% is devoted to Navy strategic programs.

TRIDENT II. The TRIDENT II (D5) development program is the Navy's highest priority and largest single R&D effort in FY 1987 at $1,632.9M. Program objectives are to develop a survivable and accurate SLBM that can destroy the full spectrum of increasingly hardened Soviet targets. We have increased the throw weight and range capability of the D5 while at the same time improving accuracy. Depending on the mix of warheads selected, we will be able to significantly increase range or throw weight over the current TRIDENT I (C4) missile, while maintaining the requisite accuracy to achieve a hard target kill capability. The TRIDENT II program has entered the third year of full scale engineering development. During the past year we have commenced substantial ground testing of individual components and subsystems including the missile, launcher, navigation and guidance subsystems. We are on track for the first flight test of the D5 missile in January 1987. We have carefully defined, developed and protected the ship subsystem interfaces with the TRIDENT II weapon system in order to meet the FY 1988 delivery of that ship. As a consequence, any additional funding reductions will be applied against the missile subsystem in order to preclude impact to the shipbuilder's schedule. That could delay the flight test program and slip the TRIDENT II IOC. Currently, our deliveries of weapons systems components to the shipbuilder are on schedule to meet the planned delivery of the SSBN-734, the first Trident submarine to be outfitted with the D5 missile, in order to meet the mandated December 1989 IOC.

STRATEGIC COMMUNICATIONS. Our budget request of $161.6M will support efforts that will enhance the survivability and connectivity of strategic communications systems to match the increased capabilities of our SLBM force. The TACAMO system is a vital survivable connectivity link to our SSBNs. Although our present EC-130 fleet provides the necessary connectivity today, it does not have the capacity to cover future expanded SSBN operating areas. The E-6A aircraft will provide the required connectivity to TRIDENT II equipped SSBNs because of its' improved range, speed, power, endurance and growth capacity. This year we will commence production of two E-6A TACAMO aircraft. In order to realize the expanded range capability of the E-6A aircraft, we are developing improvements that will increase communications injection range to TACAMO. Features such as the Compact VLF communications system and MILSTAR terminal capability will be integrated into the TACAMO communications suite in the early 1990s.

The ELF Communications System will provide continuous, jam-proof Extremely Low Frequency communciations reception connectivity to our deployed SSBNs and SSNs, while submerged at operational depths and speeds thus reducing vulnerability and improving survivability. This past year we conducted a technical evaluation of the first phase of the ELF system using the Wisconsin transmitting site and deployed submarines. From those results, we expect to exceed the design performance level of the system and achieve deeper reception depth, higher reception speed or earlier decode time for ELF messages. We have just completed the operational evaluation of ELF and we expect to achieve IOC during the current fiscal year. The second phase of the ELF transmitter system under construction in Michigan will be completed in FY 1987. Testing of dual transmitter synchronous operation will be conducted during a later phase of operational testing.

VICE ADMIRAL ALBERT J. BACIOCCO, JR., USN
DIRECTOR, RESEARCH, DEVELOPMENT, AND ACQUISITION

A native of San Francisco, California, VADM Baciocco graduated from the United States Naval Academy in June 1953. He initially reported for duty in the heavy cruiser USS SAINT PAUL (CA 73), then engaged in the Korean conflict, and served on board until December 1954. He then attended Submarine School in New London, Connecticut, and subsequently reported to the attack submarine USS WAHOO (SS 565) in Pearl Harbor.

In early 1957, VADM Baciocco was selected for the Nuclear Power Program and upon completion was assigned as Division Director and instructor in the Nuclear Department of the Submarine School.

Assignment to the commissioning crew of USS SCORPION (SSN 589) followed in 1959 after which in 1961, he served as Engineering and Executive Officer aboard USS BARB (SSN 596) prior to assuming command of USS GATO (SSN 615) in June of 1965.

Following this primary command tour, VADM Baciocco assumed command of Submarine Division Forty-Two, the first nuclear attack submarine division in Charleston, South Carolina.

Washington duty followed in 1971, where he served as Head of the Attack Submarine Branch under the Deputy Chief of Naval Operations (Submarine Warfare) until 1972 when he was reassigned as Executive Assistant and Naval Aide to the Assistant Secretary of the Navy (Financial Management).

Returning to South Carolina in 1974 he assumed command of Submarine Squadron Four until 1976 when he again returned to Washington, D.C. as Deputy Director, Attack Submarine Division in the Office of the Chief of Naval Operations.

Selected for Flag rank in 1977, he assumed duties as Director, Attack Submarine Division and SSN Program Coordinator and as Director, Deep Submergence Systems Division and Deep Submergence Program Coordinator until 1978 when he was appointed Chief of Naval Research, a command comprised of over four thousand civilian and military personnel charged with the responsibility for planning direction of the Naval Establishments' basic research program.

In 1980 VADM Baciocco was assigned additional duties as Chief of Naval Development and Deputy Chief of Naval Material (Technology) whereupon he established the Office of Naval Technology and assumed new responsibilities directing the planning and execution of all Department of the Navy Technology Base (basic research and exploratory development) programs.

Assignment as Commander Submarine Group Six brought VADM Baciocco again to Charleston, South Carolina where, in that capacity, he was responsible for the training and readiness of submarine force units in the Southeastern United States. While there he also assumed additional duties as Commander Naval Base Charleston in the latter half of 1982.

VADM Baciocco was assigned to his present position as the Director, Research, Development and Acquisition (OP-098) on the staff of the Chief of Naval Operations in August 1983.

VADM Baciocco has been awarded the Distinguished Service Medal, the Legion of Merit with three Gold Stars, Meritorious Service Medal, Navy Commendation Medal, Meritorious Unit Commendation, Navy Expeditionary Medal, China Service Medal, National Defense Service Medal with star, Korean Service Medal with star, United Nations Medal, and Korean Presidental Unit Citation and the French Order of National Merit with the rank of Commander.

VADM Baciocco is married to the former Mary Jane Rivera of Coronado, California. They have four children LT David A. Baciocco, USN; Mrs. Debra Ann Miller of Spartanburg, South Carolina; Andrew Joseph and Mary Susan.

Department of the Air Force

STATEMENTS OF:

HON. THOMAS E. COOPER, ASSISTANT SECRETARY OF THE AIR FORCE (RESEARCH, DEVELOPMENT, AND LOGISTICS)

LT. GEN. BERNARD P. RANDOLPH, U.S. AIR FORCE, DEPUTY CHIEF OF STAFF (RESEARCH, DEVELOPMENT, AND ACQUISITION)

NAVY/AIR FORCE UNITY ON BUDGET

Dr. COOPER. Thank you, Mr. Chairman.

It is a pleasure to be back. This is our first appearance this year and it is a special treat for me to appear with my Navy colleagues, particularly with my good friend, Mel Paisley.

As Mel mentioned, it is often alleged that the Air Force and Navy are not able to work together. I have to tell you nothing could be further from the truth. Particularly this time of the year when we are united against a common threat which forces a show of solidarity against the threat that you are about to cut our budget. So, we will try to make our argument as persuasive as we can.

You introduced General Randolph. I might mention this is General Randolph's first appearance before this committee in his capacity as Deputy Chief of Staff for Research, Development, and Acquisition.

We do have a prepared statement, Mr. Chairman. I am prepared to summarize that. In the interest of time, if you would prefer to go into questions, I will do as Mel Paisley has done and forego my remarks.

Senator STEVENS. We appreciate your statement. We will be happy to have you summarize and highlight your priorities if you would like to do that.

I do not think you ought to say we are about to cut your budget. The budget has already been cut. The question is, Where are the priorities? We will be happy to get some answers.

Dr. COOPER. I will take a few minutes then and go through our priorities, and Mel, you may want to join in.

STRATEGIC MODERNIZATION PROGRAM

Perhaps to frame this, let me go back to 1981 when the President put forth his Strategic Modernization Program. As you will recall, there were five components to that Strategic Modernization Program.

First and foremost was to modernize and strengthen our command, control, and communication network.

The President also, as a second element, wanted to modernize the sea-based leg of our deterrent, modernize the land-based leg, the ICBM force.

Part three and part four was to modernize the air-breathing leg, the bomber force.

And part five was to pay more attention to the defensive part of our strategic deterrent.

Let me just say a word about a couple of those, Mr. Chairman.

C-3 NETWORK MODERNIZATION

In terms of modernizing our C-3 network, we have a very aggressive program underway in the Air Force and the Navy has a part of that as well, but in our area we are emphasizing both ground-based systems and satellite-based systems. It is a very vigorous program.

Two of the key programs we are working on today are the MILSTAR Satellite Program—you are familiar with that—it is going well, it is in the FSD phase, full-scale development.

Also the ground wave emergency network system, so-called within the GWEN Program. This is the first year of production of this program. I think that part of the Strategic Modernization Program is going very well indeed. It does not get an awful lot of attention, but I think it is critical because that is the critical nervous system of our strategic posture.

ICBM LEG OF TRIAD

Turning to the ICBM leg of the Triad, as you know, it has three parts and that followed from the Scowcroft Commission recommendations. The first part of that was to deploy 100 Peacekeeper missiles in existing Minuteman silos. Last year Congress gave us authority to deploy the first 50 and in the Minuteman silos, but told us to go out and study and look to see if there was a more survivable basing mode we could come up with for the second 50.

We are currently in the process of doing that. We have eight candidates we are looking at, eight alternative basing modes. We anticipate that we will make a selection sometime late in the year, probably about the December timeframe.

PEACEKEEPER PROGRAM

We will then be back to you with a proposal. I might just mention that the Peacekeeper is, in my opinion, probably the most successful program technically in Air Force history. I know of no other program that is as successful technically as the Peacekeeper. We are 11 for 11 in our test program and the accuracies are absolutely superb. As you know, they are classified, but really tremendous accuracies.

The program proceeds on cost, it is within schedule, and we anticipate accepting our first operational missile in the Strategic Air Command in September of this year. We will reach an IOC in December when we anticipate we will have 10 Peacekeepers deployed at Francis E. Warren. That program is going very well indeed.

SMALL ICBM PROGRAM

The second part of the ICBM modernization program was to develop and deploy a small ICBM. That program is likewise on track. We have a program office at the ballistic missile office at Norton Air Force Base in California. It has over 200 people. We have very vigorous competition ongoing and we anticipate we will make a full-scale development decision sometime during the first quarter of the next fiscal year, most probably in the December timeframe.

Now, as you know, the small ICBM program that we have been pursuing is the single-warhead small ICBM in the 30,000-pound class. That has been mandated by Scowcroft and also by law.

We have been asked recently by the Office of the Secretary of Defense to look at alternatives to these single-warhead small ICBM's. We are currently in the process of examining both two-warhead and three-warhead versions of a small ICBM.

If we were to go to one of those, that would obviously necessitate increasing the weight. That might in some way impact on mobility. Those are the tradeoffs that we are looking at right now.

Intuitively, one would think if you could deploy a two- or three-warhead small ICBM, that would be more cost effective than a single-warhead small ICBM. The same number of people would be taking care of more warheads. That is what your intuition would tell you.

Also, your intuition would tell you it would impact on mobility. Rather than have our intuition make that determination, what Dr. Hicks has asked us to do is take a rigorous analytical look at those tradeoffs. We anticipate we will be back with the answers to those questions sometime in the November timeframe.

In the meantime, we are continuing to execute the single-warhead program. I would mention to you it is our best engineering judgment that if a decision is made to stay with the single warhead small ICBM, we believe it should be more in the 37,000-pound category as opposed to 30,000 pounds. That will give us about 250 pounds more throw weight.

We can either convert that to additional range or, if needed, we could put penaids on it. That would be our recommendation to you if we stay with the single-warhead small ICBM.

BASING TECHNOLOGY PROGRAM

In addition to those two points, the third point in the Scowcroft Commission recommendation is that we should be actively engaged in a rigorous basing technology program. As you know, our current baseline program for the small ICBM is the hard mobile launcher. We have also been looking at superhard silos.

SUPERHARDENED SILOS

As a result of the work we have done over the past year, it is now our best estimate that we can in fact deploy superhardened silos that will be between 25 and 50 times harder than current generation silos.

When I was here last year I indicated to you that one of the down sides of that was cost. Our estimates at this time last year were that 50 of those silos in 1982 dollars would cost on the order of about $10 billion. That includes the R&D that goes along with it.

As a result of a year's work and better information, we now believe that we can deploy 50 super hard silos for a cost of about $6 billion in 1982 dollars. We have actually refined it more than that. We say it is $5.6 billion.

I think really within our ability to predict right now, we are talking not $10 billion, as we told you last year, but more on the order of $6 billion. Very promising results that we have obtained over the last year.

BOMBER MODERNIZATION PROGRAM

That is a word about the ICBM program, Mr. Chairman. Let me turn briefly to the second key part of our part of the Triad and that is the bomber modernization program. That part of the program is designed to maintain the effectiveness of the B–52 force in the near term while we are in the process of developing and deploying an enhanced bomber capability for the future.

Our plan contains those three elements. I might say a word about each.

Relative to the B–52's, we have been in the process of equipping both the G's and the H's to carry air-launched cruise missiles. We have 167 of the B–52G's. We are going to equip 98 of those to be cruise missile compatible. In fact, we have completed that equipage. All five B–52G squadrons are equipped with ALCM's and are on the ramp.

We are in the process of modifying 96 of our B–52H's to carry cruise missiles. At some point we will run up against SALT limitations with our no-undercut policy. Without cutting SALT, we can equip 30 of the B–52H's and then we reach a decision point whether we go forward. That is a decision the President will make, I am sure, in consultation with the Congress.

At that point the decision point will come sometime later in October of this year. That program is on track and is going well.

I am proud to say the B–1 is also on track and going well. We have delivered six operational B–1s now to Dyess Air Force Base in Texas. Either tomorrow or Monday we should deliver the seventh. Our plan is to deliver a total of 100. We expect to reach an IOC of 15 aircraft in September of this year and the program is on track.

I do need to run up a red flag for you, though. Congress has cut our budget over the last couple of years in the B–1 line. We have committed to deliver those 100 B–1's for $20.5 billion. We currently have $19.5 billion in hand. There is no request this year in production for B–1's.

I anticipate that sometime in the not too distant future we will probably have to come back to the Congress and ask them to restore a portion of that $1 billion that has been cut. Our contract with the Congress was to deliver 100 for $20.5 billion. We currently only hold $19.5 billion in hand.

You may have seen some articles in the press recently that would give an impression that we have an overrun. That is not the case. Our concern is with the $19.5 billion. I do not have a proposal to give you today. I just lay that out on the table as a concern that we have that we do not think we will be able to do the program for $19.5 billion that we currently have in hand.

The last part of the Bomber Modernization Program, Mr. Chairman, is the advanced technology bomber. About all I can say about that in open session is that it is moving smoothly forward, it is on track, we are pleased with it and we fully anticipate we will meet the early 1990's IOC that we previously briefed to the Committee.

With that, Mr. Chairman, the staff had asked that we perhaps give you a very quick overview of the Defense Support Program and our Anti-Satellite Program. There is an awful lot of interest in that as well.

If I could, I would like to turn to General Randolph to give you a brief overview of both the DSP and ASAT.

Senator STEVENS. Fine. Go ahead, General Randolph.

STATEMENT OF GEN. BERNARD RANDOLPH

General RANDOLPH. Thank you, Mr. Chairman.

This will only take a couple minutes.

The Defense Support Program, without getting into classified details, in its purpose, as I am sure you are well aware, is a top-priority national program. It is, of course, critical to our defense system and it supplies data from space to our North American aerospace defense forces in Colorado Springs.

SATELLITE PURCHASE

Now, we propose to buy five additional satellites beginning in fiscal year 1987 and those satellites are almost identical to the four that we have previously bought in fiscal 1983 and 1984. Our proposal is to buy those satellites by multiyear and that is really the issue that I want to address.

The satellites are being requested on the basis of need; that is, the need is a statistical determination that we must have those satellites at a certain time and that statistical determination has been borne out over the years to be quite accurate and correct.

With the use of the multiyear proposal, we would save the taxpayer about $329 million over the normal annual buy approach that you would use if you buy those satellites. Now, given that we are going to buy the satellites and we believe that they are critical for national defense and given that we propose to buy the satellites on that schedule, it seems to us that the better course of action is to press forward with the multiyear.

However, because of Gramm-Rudman, there has been some concern as to the advisability of our entering into a contract over several years and then have the automatic cut kick in and thereby void the contract. Let me just say two things about that.

First of all, the amount of money that is being asked for in the particular line includes not only the satellites, but also some ground equipment. It is, therefore, possible that we could take the cut from the ground equipment, not a good thing to do, very painful, but nonetheless, possible, and thereby not void the contract.

The other point I would like to mention, however, is that we asked ourselves what is the worst thing that could happen if we indeed did void the contract? The worst thing that could happen is that we would have to pay the $329 million that we proposed to save.

So, it strikes us that the prudent course of action is to allow the multiyear to save the $329 million and at least give ourselves the chance to make that savings and only under the worst of conditions would we have to restore that money.

OPERATIONAL SPACE SYSTEMS

One other point. I believe this is something that really applies to all operational space systems. We build operational space systems on the basis of need. They are very small in terms of quantities. In order to get the economy of scale, in order to try to set up some kind of production line for the very small quantities of space systems that we have, it is indeed prudent to buy operational space systems by multiyear and that, of course, includes the launch vehicles that go with them.

ANTI-SATELLITE PROGRAM

The second point, Mr. Chairman, that I would like to briefly address is the Anti-Satellite Program. Of course, I recognize that that program is extremely controversial. I will only say a couple things on that.

First of all, as you know, the Soviets do have an operational antisatellite capability and the United States does not. It strikes me that such an asymmetry certainly is a problem in terms of stability. I do not pretend to be an expert on those subjects, but it certainly seems that way.

I would like to say three things about the antisatellite system.

TESTING

First of all, in the testing area we are proposing in fiscal 1987 in our request to conduct three tests against objects in space. We recognize that in fiscal 1986 this has been prohibited by the Congress and, of course, we are abiding by that law that was passed in fiscal 1986.

We do plan, however, in fiscal 1986 to conduct two tests against the radiance of a star, that is, to exercise the software and some of the hardware. Obviously, this is not the most ideal way to test, but we have planned to conduct one of those tests, at any rate, as part of our overall fiscal year 1986 test program. So, we simply increased that to two for the time being.

COST

The second point I would like to talk about is cost. There has been a lot of discussion about the cost and I would like to point out the fact that unit cost of the ASAT missile in the procurement sense has increased less than 10 percent. We reduced the numbers of missiles that we propose to buy in our phase one and the reason why we reduced the numbers is because we recognized there are certain technologies that are coming along that might be used for the ASAT purpose in the 1990's.

So, we elected to make a decision in 1990 as to whether or not we should continue beyond that initial, much lower number that we had previously told the Congress. I am not telling you the number because the number is classified, but it is in the information that you have.

By virtue of the fact that we reduced the number, that increased the unit cost. However, we should also point out that the research and development dollars did not change substantially.

The end result of that is when you do the selected acquisition report and you spread the research and development dollars over a fewer number of operational missiles, it gives the appearance of an increase in cost in the operational missiles. I would like to point out to the committee that that appearance is deceiving.

GAO REPORT

The last point is the GAO report. I will have to say in all candor, Mr. Chairman, I was extremely disappointed in the GAO report. While it is not unusual for us to disagree with the conclusions of GAO reports, it is unusual for us to disagree with the entering facts.

Unfortunately in this report the GAO began with information that was simply not correct. Among the kinds of information that I am talking about are the costs and the requirements. I will be pleased to address that in the question and answer session, but we have provided to the staff members of the committee the details of our disagreements so that you can have that information available.

Mr. Chairman, that concludes my remarks.

[The joint statement of Mr. Cooper and General Randolph follows:]

JOINT PREPARED STATEMENT

THOMAS E. COOPER, ASSISTANT SECRETARY OF THE AIR FORCE,
(RESEARCH, DEVELOPMENT AND LOGISTICS)
GEN. BERNARD P. RANDOLPH, USAF, DEPUTY CHIEF OF STAFF,
(RESEARCH, DEVELOPMENT AND LOGISTICS)

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

It is a great pleasure to speak to you today regarding the Air Force's strategic systems. As you are well aware, the basic military strategy of the United States is the deterrence of war by making a potential aggressor unwilling to take the risk of starting a conflict. The security interests of the United States and its allies continue to be challenged by the sustained growth and improved performance of Soviet military forces, Eastern bloc, and surrogate exploitation of regional conflicts and instabilities in many areas of the world.

The United States' strategic nuclear forces provide deterrence through Submarine-Launched Ballistic Missiles (SLBMs), land-based Intercontinental Ballistic Missiles (ICBMs) and manned bombers. These forces, known as the Triad, are the mainstay of our nation's nuclear deterrent. The structure of the Triad discourages a first strike against the United States by complicating Soviet efforts to attack or defend against this retaliatory mix of forces.

Mr. Chairman, you have just heard from the Navy regarding their leg of the Triad. We will discuss the remaining two portions of the Triad--the ICBMs and manned bombers--as well as strategic defense forces.

LAND-BASED ICBMs

Our ICBM modernization program stems from the need to begin modernizing an aging force and to redress the strategic asymmetry caused by the massive Soviet ICBM build-up which began in the early 1970s. Since then, the Soviet Union has deployed more than 800 SS-17s, SS-18s and SS-19s. More than half of the Soviet ICBM force has been deployed since the last U.S. ICBM deployment. In addition, the Soviets are deploying a mobile ICBM system, the SS-25. They are developing a second missile--the SS-24--a missile the size of a Minuteman. While the first mobile U.S. system, the Small ICBM (SICBM), is just beginning development.

To address the strategic imbalance, the President endorsed the ICBM Modernization Program in April 1983. The program was recommended by the President's Commission on Strategic Forces (Scowcroft Commission) and subsequently approved by the Congress. This program was built on the recognition that all ICBM tasks cannot be served by a single weapon system. Accordingly, the Commission recommended (1) promptly deploying 100 Peacekeeper missiles in existing Minuteman silos; (2) initiating engineering design of a single warhead ICBM leading to deployment in the early 1990s; and (3) vigorously investigating follow-on basing technologies, including hardened vehicles and silos.

The Fiscal Year 1986 Authorization Act has amended the Scowcroft program by reducing the Peacekeeper deployment in existing silos from 100 to 50 specifying that deployment of additional Peacekeepers would be subject to Congressional approval of a more survivable basing mode. As a result, we are studying advanced basing modes for additional Peacekeeper missiles as well as conducting research and development on a Small Mobile ICBM.

PEACEKEEPER

The main purpose of deploying the Peacekeeper missile system, with initial operational capabilityin December 1986, is to more effectively deter Soviet threats of massive conventional or nuclear attack against the United States and our allies. By virtue of its improved damage expectancy against hardened military targets, Peacekeeper accomplishes several strategic deterrent objectives. First, the near-term Peacekeeper deployment begins to offset the large Soviet advantage to destroy hardened U.S. land-based targets. Peacekeeper is the only U.S. strategic system with the range, yield and accuracy to place at risk the Soviets' hardest and most highly valued strategic targets. Second, deploying Peacekeeper in existing Minuteman silos helps modernize the U.S. ICBM force. Third, Peacekeeper deployment encourages the Soviet Union to negotiate stabilizing arms control agreements. Thus, the Peacekeeper deployment is the first step toward enhanced deterrence, increased strategic stability, modernization of our aging force, and meaningful arms control negotiations. The Peacekeeper research and development flight test program, consisting of 20 planned launches, was initiated at Vandenberg AFB, California, in June 1983. Phase I of the flight test program, completed in June 1984, was designed to test missile functional performance. Phase II is designed to test missile/reentry vehicle capabilities and silo integration. Eleven launches, all successful, have been completed to date. Flight test 9, the first launch from an operationally configured silo, was successfully completed in August 1985. Flight test 10, the second silo launch, was successfully completed in November 1985 and flight test 11 was recently conducted on March 7, 1986. Peacekeeper accuracy is outstanding with demonstrated results considerably better than the design requirement.

Congressional concern in Fiscal Year 1986 with the issue of vulnerability of existing silos resulted in a Fiscal Year 1986 Authorization limitation of 50 Peacekeepers deployed in existing Minuteman silos. We continue to believe that 100 Peacekeepers in existing silos make would make an important contribution to deterrence. We support the Scowcroft observations that, due to the "mutual survivability shared by the ICBM and bomber force" the vulnerability of existing silos should not be the dominant factor in addressing ICBM modernization in the near term. In the long term, the Scowcroft Commission recommended assessing alternate basing modes as a way of solving the problem of long term ICBM survivability.

In recognition of Congressional desire for additional survivability, we have increased our emphasis on the Follow-on Basing program to consider alternative basing modes for additional Peacekeeper missiles which include not only hardened aim points, but mobility and concealment as well. Study of these basing modes will continue in Fiscal Year 1987 with a narrowing of alternatives to the most promising candidate in preparation for a potential Fiscal Year 1988 Full Scale Development (FSD) start. While these studies are primarily focused on Peacekeeper, they are also applicable to follow-on Small ICBM deployments.

Peacekeeper production, deployment and support activities are on schedule and within cost. Fiscal Year 1987 funding will be used to complete the last six RDT&E test flights, continue production of test missiles (21), conduct ground testing and evaluation, construct support facilities and continue studies of Follow-on Basing modes.

SMALL ICBM

The main purpose of deploying the Small ICBM (SICBM) is to enhance the survivability, flexibility and stability of the ICBM force by adding the capability to retaliate effectively across the entire spectrum of conflict. By virtue of its high survivability and prompt hard target capability, the SICBM greatly enhances our ICBM deterrent capability and fosters long term stability in the ICBM component. In conjunction with Peacekeeper, SICBM is an important step forward toward modernizing our ICBM force.

The concept definition phase began in 1983 and was completed in late 1984. It involved building on Peacekeeper advanced technology as well as assessing alternative technologies. Pre-full scale development began in late 1984. To date, more than 18 SICBM competitive contracts have been awarded for this effort encompassing propulsion, hard mobile launcher, hard silo, guidance and control, weapon control system and assembly, test and system support. The propulsion contractors have tested full scale prototype motor stages, exit cones, thrust vector control systems, and lightweight motor cases. Full scale stage testing will continue in 1986.

We have tested scale models of the hard mobile launcher (HML) for blast, hardness, radiation and mobility. These tests will continue in 1986. Both Martin Marietta and Boeing have built HML Mobility Test Vehicles (MTV) that replicate HML size, weight, horsepower and handling characteristics. Both MTV rollouts occurred in September 1985 and the two contractors began MTV testing. The vehicles were delivered to the Air Force in January 1986 for rigorous government mobility testing which will continue through the remainder of this year.

Efforts in the SICBM guidance research and development continue in initial development. To decrease system weight and reaction time without degrading system accuracy and to reduce unit cost, we are evaluating three alternative inertial navigation guidance systems as competitors to the baseline modified Peacekeeper Advanced Inertial Reference Sphere (AIRS). Alternatives include two ring laser gyro and one stellar inertial system. This competitive guidance effort will continue through Fiscal Year 1988 when a primary guidance system will be selected. We have made considerable progress in the Small ICBM development to date. The full scale development phase for the basing mode or modes will begin in Fiscal Year 1987 leading to flight testing in 1989 and Initial Operational Capability (IOC) in 1992.

MANNED BOMBERS

The second and most flexible and versatile leg of the Triad is the manned bomber. The bomber interacts with the ballistic missiles to enhance overall force effectiveness. It provides insurance against an unexpected failure or reduced effectiveness of other strategic force elements. The manned bomber is recallable, reusable and can deliver a wide range of weapons from nuclear to conventional gravity bombs, maritime ship attack missiles, short range attack missiles and cruise missiles. The bomber can be launched for a show-of-force and it can be dispersed to a variety of locations. The manned bomber has the added feature that it can make real-time damage assessment during attack and it can also be redirected while in flight. The manned bomber has the most near-term capability to locate, identify and strike strategic relocatable targets. Because the bomber carries a mix of gravity weapons, short range attack missiles, and cruise missiles, it severely complicates the Soviet air defense problem.

CURRENT SYSTEMS

For over a quarter of a century, the B-52 has served as the backbone of our strategic bomber force. The current B-52 fleet of 241 aircraft is augmented by 56 FB-111As.

The B-52, as the mainstay of our bomber leg of the Triad, provides those unique characteristics which only a strategic bomber can provide: flexibility to respond with conventional or nuclear weapons in a tactical or strategic role on land or at sea and meet last second contingencies that arise in the target area; recallability after launch; and reusability with minimum turnaround time.

Because of the age and limitations of our existing bomber force, we have initiated a phased modernization program for our manned bomber. The B-52 has been modified to carry the Air Launched Cruise Missile (ALCM), assuming a role it will maintain into the 1990s. The newer B-52H aircraft will be capable of carrying 20 cruise missiles, 12 externally and 8 internally. By the end of the decade, the B-1B will be our primary penetrating bomber while the B-52 assumes a primary role as a cruise missile carrier.

B-1B

The B-1B fills the need for a new multirole strategic bomber to be operational in 1986. The B-1B provides improved range and payload for the strategic nuclear bombing and cruise missile launch missions. In addition, the B-1B can perform tactical and strategic conventional bombing missions. The B-1B will serve initially in the penetrating role and later in the cruise missile shoot-and-penetrate role.

On June 27, 1985, the Strategic Air Command took delivery of its first B-1B. The Fiscal Year 1987 B-1B RDT&E program concentrates on demonstrating and maturing the B-1B's operational capabilities. These activities will be conducted at Dyess AFB, Texas and Edwards AFB, California. The final lot of 48 B-1Bs are procured with Fiscal Year 1986 funds. Initial operational capability will occur September 1986, with 15 B-1Bs at Dyess AFB, Texas. Full operational capability occurs with delivery of the 100th aircraft in the Spring of 1988.

ATB

The Advanced Technology Bomber (ATB) will follow the B-1B and is designed to ensure that our Triad force has the advantage of new developments in low observable technology to combat expected advances in Soviet defenses. The ATB program is part of the President's strategic modernization program announced on October 2, 1981. The two bomber program is the most prudent approach to revitalize our bomber force. The ATB will provide a significant improvement in our ability to deal with advanced air defenses.

At the present time, development and procurement plans remain classified, but but we can state that the RDT&E program is adequately funded, and within schedule for an early 1990s initial operational capability. The ATB R&D program is proceeding on schedule and at the fastest prudent pace. When delivered in the early 1990s, the Advanced Technology Bomber will provide high confidence that our bombers can continue to penetrate Soviet defenses into the next century as well as providing the flexibility and other unique military characteristics that only a manned strategic aircraft possesses as an instrument for national objectives.

STRATEGIC DEFENSE FORCES

Strategic defense forces and systems are key elements of our deterrent posture. These forces form the backbone of our ability to warn of aircraft and missile attacks, monitor potential threatening activities and defend against atmospheric and space-based threats to U.S. forces. They ensure that our National Command Authority's strategic retaliatory capability will survive any Soviet attempt at a first strike by providing timely, reliable and unambiguous warning as well as attack assessment and ultimately damage limitation. The two programs within the strategic defense arena which we plan to address are the ASAT and Defense Support Program.

ANTISATELLITE PROGRAM (ASAT)

The Space Defense Program continues development of a low-altitude miniature vehicle ASAT system. The primary purposes of an ASAT capability are to deter threats to space systems of the United States and its Allies, and within such limits imposed by international law, to deny any adversary the use of space-based systems that support hostile military forces.

On September 13, 1985, the ASAT system was successfully tested against a resident space object. The test was flawless. Fiscal Year 1986 Public Law prohibits us from testing the ASAT against an object in space until the President certifies that the Soviets have conducted a test of their dedicated ASAT. We have restructured our Fiscal Year 1986 test program to comply with the law. This approach consists of conducting two flight tests against the radiation of a star. Also, based upon an Air Force independent review, we have initiated a production verification effort to improve missile productivity, supportability and operability and reduce program concurrency. We have also revised the total force structure to meet the near-term threat and are investigating other technologies in addition to the air-launched system which could provide an ASAT capability. In Fiscal Year 1987, we will continue to test the ASAT missile and continue the production verification program, begin construction at Langley AFB, Virginia, and procure long lead parts for our operational missiles.

DEFENSE SUPPORT PROGRAM

The Defense Support Program (DSP) is critical to our nation's strategic defense posture. This program provides data to the National Command Authority, North American Aerospace Defense Command, and Strategic Air Command. Our development efforts are aimed at increasing the survivability of operational data through design of ground station modifications. These stations will be made compatible with the survivability improvements of follow-on satellites.

To meet near-term requirements, four DSP satellites were procured: two in Fiscal Year 1983 and two in Fiscal Year 1984. They are on schedule with the first to be delivered in Fiscal Year 1987. In Fiscal Year 1986, we are continuing ground station compatibility modifications and have successfully completed testing all mobile ground terminals. In Fiscal Year 1987 we plan to initiate the multiyear procurement for the next block buy of DSP satellites. This high priority effort is one of only two Air Force requests for new multiyears, the other being for Complementary Expendable Launch Vehicles, the means to place DSP satellites in orbit. A minimum of five satellites will be needed to maintain the constellation to the middle 1990s. Projected multiyear savings for these satellites are $329 million, a 20 percent savings compared to annual contracting. In addition to these direct cost savings, we believe the multiyear approach to be the most economical method of providing timely deliveries to meet the critical launch need dates. Fiscal Year 1987 will also continue research and development with primary emphasis aimed at minimizing/eliminating operational employment deficiencies and vulnerabilities; ensuring a launch capability through the use of either the Complementary Expendable Launch Vehicle or the Space Shuttle; developing a more survivable DSP system through upgrades to the Mobile Ground System and satellites, and ensuring adequacy of ground station data processing capabilities.

CONCLUSION

We have made substantial progress toward the commitment to ensure that our military capabilities are strong enough to fulfill their vital purpose. The Fiscal Year 1987 budget request continues a careful balance based on a realistic assessment of the threats. Congressional approval and funding for our Fiscal Year 1987 budget request will allow us to continue the plan and demonstrate unified national resolve and protect and defend worldwide national interests.

Air Force Acquisition Statement

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C.

MEMBERS OF CONGRESS

Over the past few years, we in the Air Force, with your support, have been able to make significant improvements in our forces. As a result, these forces are now better equipped, more capable, and at their highest peacetime readiness levels than at any time over the past decade. Our Fiscal Year 1987 budget supports these improvements. Moreover, our improved acquisition process will ensure that we make the best possible use of public funds we now request.

Though economic influences on our budget may change from time-to-time, the threat does not. The Soviets continue their unrelenting military growth, and the potential for low-level conflict which may involve the United States steadily increases. This is clearly not the time to reduce the momentum of our force modernization.

Air Force priorities--strategic force modernization; improved readiness and sustainability of our general purpose forces; increased airlift capability and modernized and expanded tactical forces; and improved capabilities in space--are formulated to best support our national military strategy. This budget is a well-balanced approach to achieving required growth in each of these areas.

We support our national commitment to a balanced federal budget. Our greatest contribution to this goal will be a careful stewardship of the resources entrusted to us. We have reduced the number of programs we manage, we have made great progress in increasing competition in our acquisition programs, and are actively pursuing other cost reduction measures. Further, we are aggressively participating in joint service acquisition programs and actively seeking cooperation with our NATO and other allies to reduce costly duplication of effort. In sum, we are working hard to do more with less.

We look forward to discussing our programs with you and request your support of our Fiscal Year 1987 budget.

Thomas E. Cooper

THOMAS E. COOPER
Assistant Secretary of the Air Force
Research, Development and Logistics

BERNARD P. RANDOLPH, Lt Gen, USAF
Deputy Chief of Staff,
Research, Development and Acquisition

DEPARTMENT OF THE AIR FORCE
MCMXLVII
UNITED STATES OF AMERICA

EXECUTIVE SUMMARY

The U.S. Armed Forces protect and preserve the United States as a free nation. U.S. forces help assure the physical security of the United States as a democracy and protect U.S. interests abroad. The basic military strategy of the United States is the deterrence of war by making a potential aggressor unwilling to take the risk of starting a conflict. The security interests of the United States and its allies continue to be challenged by the sustained growth and improved performance of Soviet military forces, Eastern bloc, and surrogate exploitation of regional conflicts, and instabilities in many areas of the world.

The Soviets continue to increase and modernize their nuclear and conventional forces as well as their capabilities for projecting military power. Together with surrogates, they are attempting to weaken the ties between the United States and its allies and extend their influence in the Third World. Soviet military interventions further impede the peaceful resolution of Third World problems and contribute to regional instability by promoting wider conflict.

U.S. military strategy seeks to deter attacks against the United States and its allies, limit Soviet opportunities for coercion, and provide the flexibility to respond appropriately to aggression and terrorism . Therefore, U.S. forces must be capable of operating effectively throughout a spectrum extending from low-intensity conflict to strategic nuclear war. Readiness, sustainability, modernization, and a sound force structure are imperatives of the U. S. military posture.

Through the President's commitment to long-term defense modernization, our forces have reached a higher peacetime level of effectiveness than at any other time. When the President first came into office, he was faced with ten previous years of U.S. military decline while the threat was continually increasing. During the past five years, real growth in our military investment accounts (procurement, research, development, test and evaluation, and military construction) has resulted in the modernization of our equipment and a simultaneous increase in our readiness and sustainability for support of larger forces in the U.S and overseas.

Because of the steady rebuilding of our military capability, our strategic forces have become more capable and survivable; our tactical aircraft mission capable rates and wartime fighter sortie generation capability have drastically improved;our strategic airlift fleet has increased; and our command, control and communications have become faster and more survivable. All of these improvements to our force structure enable the U.S. military to better carry out the national security policy of protecting and defending American interests throughout the world.

The Fiscal Year 1987 investment in research, development, test and evaluation, procurement and military construction provides the future force structure capability to meet our national security objectives. The Fiscal Year 1987 investment programs account for 56% of the entire AF budget request. We feel this mix represents the most reasonable balance between operating our forces at a high level of readiness and investing in the development of future weapon system capabilities.

Our qualitative edge over the Soviets has been narrowing due to the large Soviet expenditures in science and technology and an intense program to acquire our latest weapons technology. Given our strategy to counter the large quantities of Soviet weapons with our technologically superior weapons, we must continue and increase a broad-based scientific and technology program across all mission areas. We cannot wait until the Soviets further close the technology gap because of the long lead-time required to field weapon systems utilizing new technologies.

Further, we must shorten the development cycle for technologies which promise a high payoff in countering the projected threat.

To transition our science and technology efforts into development and production, we require a sound industrial base that can operate in both peace and wartime. Today's industrial base for producing defense equipment consists of privately-owned and government-owned facilities. The Air Force's Industrial Base Program analyzes current industry capabilities in light of acquisition programs and develops goals that tie industrial productivity enhancements to wartime responsiveness.

We must also improve readiness and sustainability despite increased weapon system performance and complexity. Our aircraft have to be able to deploy quickly to austere bases, and sustain high combat sortie rates. To accomplish these demanding requirements, the Air Force's Reliability and Maintainability (R&M) 2000 program is designed to accelerate R&M efforts in both fielded and new weapon systems. The two research and development programs that offer high payoffs are the R&M Maturation and Technology Insertion Program, and the Productivity, Reliability, Availability, Maintainability Program.

To develop a large array of sophisticated yet reliable and maintainable weapon systems within a period of austere resources, we must continue our efforts to improve our stewardship of the defense dollars allotted to us. We have instituted several acquisition management enhancement programs that are intended to reduce the cost of weapon systems, improve the spare parts acquisition cycle, create a top notch professional acquisition staff, and encourage a greater cooperation with our NATO partners in developing and acquiring weapon systems. Through these and other programs, we feel we can better manage the limited funds available for Air Force programs.

Our development programs and production lines can lead to improved war-fighting capability only if our forces are trained and ready to use this modern equipment, our peacetime stocks can support day-to-day operations and training, and we have the necessary repair facilities, spare parts, and consumables to sustain our combat forces. To improve our aircrew training, we have a full array of aircraft simulators that complement actual flight time, enhance combat capability, and improve safety. Results of recent aircrew combat competitions show that our pilot wartime proficiencies have reached their highest peacetime levels in years. Our readiness has also improved with the increased emphasis placed on our peacetime spares procurement. We have kept up our commitment to funding both the initial spares needed to support new weapon systems and the replenishment spares necessary to support operations and training programs. While revised fiscal guidance has impacted our war reserve stock procurements, we are still able to fund all new wartime kit authorizations for our fighting units.

The fundamental objective of U. S. nuclear forces is to remove all incentives for direct attack against the United States and its allies by promising any attacker a devastating outcome. The Soviet Union has continued to challenge the U.S. guarantee of effective retaliation and has threatened U.S. deterrent capabilities by strengthening certain measures of Soviet nuclear strength. To counter growing Soviet nuclear war-fighting potential, the United States gives high priority to the modernization of its nuclear forces and the study of means for defending against ballistic missile attack. Equitable and verifiable arms reduction agreements are being pursued in parallel with modernization programs. The goal of the United States is a more stable nuclear balance at lower levels of armament.

The United States' strategic nuclear forces are composed of submarine-launched ballistic missiles, land-based ICBMs, and manned bombers. These forces, known as the Triad, represent our nation's resolve to deter any potential aggressor. The structure of the Triad discourages a first strike against the United States by complicating Soviet efforts to defend against this retaliatory mix of forces.

The ability to deter aggression exists only if we have the actual capability and will to retaliate. Since the Air Force is responsible for maintaining two-thirds of the Triad, the land-based ICBMs and the manned bomber, we have continued to seek modernization in both of these areas. We are modernizing our ICBM force through the upgrade of the Minuteman missile, the procurement of the Peacekeeper missile, development of a small mobile missile, and research on technologies to increase the survivability of our ICBM force. In addition, we have upgraded some of our B-52 systems to extend their lifetime and enhance their delivery capability. The B-52, through these improvements, provides an overlap until the Air Force's newest bomber, the B-1B, takes over the penetration role. To meet the expected advances in Soviet defenses, we are continuing the development of the Advanced Technology Bomber and both penetration and standoff missiles. With this new bomber and missile force mix, our bomber leg of the Triad will remain a credible deterrent to nuclear aggression well beyond the year 2000.

Strategic Defense encompasses detection of Soviet aircraft and missile attack, monitoring space activities, and defense against atmospheric and space-based threats to U.S. forces. These resources reduce the probability of a successful enemy's decapitating first strike attack, thus increasing stability between the United States and the Soviet Union.

Atmospheric surveillance and defense are responsible for the protection of North America against the air breathing threat. In Fiscal Year 1987, we will continue replacing the aging Distant Early Warning System with the new North Warning System to provide improved surveillance of the northern approaches. For coastal surveillance, we will continue procurement of the Over-the-Horizon Backscatter Radar. To ensure an effective interceptor force at lowest cost, the Air Force is holding a competition for approximately 300 new interceptors.

For space surveillance and defense, we are instituting several improvements to the SPACETRACK system, continuing space defense system tests, and improving space defense command, control and support programs.

Ballistic Missile Warning and Attacks Assessment is currently performed by a network of sensors. In Fiscal Year 1987, two new PAVE PAWS sites will be completed. These systems will provide coverage of the southeast and southwest sectors to complete 360 degree surveillance against Submarine-launched Ballistic Missiles. The Ballistic Missile Early Warning System will be upgraded by completing the replacement of 20-year old conventional radars at Thule Air Base, Greenland.

Finally, the Strategic Defense Initiative is exploring the potential of a system to counter ballistic missiles and their re-entry vehicles in flight. In Fiscal Year 1987, the Strategic Defense Initiative will continue funding five technology development areas: surveillance, acquisition, tracking and kill assessment; kinetic energy weapons; directed energy weapons; battle management/command, control, communications; and system analysis and supporting technology.

Without our Strategic Command, Control and Communication (C^3) systems, our strategic offensive and defensive weapon systems will not provide a credible deterrent against Soviet first strike. Our Strategic C^3 systems link our attack warning, defensive, and strategic retaliatory forces to command centers. They must be effective and reliable in the pre-, trans-, and post attack environment. Our current systems are being upgraded to become more survivable, and new systems are being produced and deployed to provide increased capability. In Fiscal Year 1987, the Air Force will continue development of the Milstar secure, jam-resistant communications system, the Ground Wave Emergency Network, the Minimum Essential Emergency Communications Network, and the Worldwide Military Command and Control Information System. We will continue production of Strategic Air Command Digital Network terminals and the Defense Satellite Communications System III satellites. Fiscal Year 1987 system upgrades will include the Aircraft Alerting Communications Electromagnetic Pulse Upgrade and the modifications to the EC-135 Post Attack Command and Control System and E-4B command post aircraft

Space systems significantly increase the combat effectiveness of our strategic and conventional forces. The Soviets have recognized the importance of space in military operations and have made great strides in improving their space-based assets. We also have instituted programs to upgrade our space infrastructure of launch and on-orbit facilities, increase the survivability of our space systems, and improve the surveillance, communications, and navigation capabilities of our space systems. Infrastructure upgrades will include: upgrading the Titan 34D to launch shuttle-size satellites; upgrading the Titan II ICBM into a space launch vehicle for smaller satellites; upgrading the Satellite Control Facility data systems computers; and continuing the development and acquisition of the Advanced Remote Tracking Station. Improved performance and survivability of our space systems will be accomplished through: continued development of the Defense Meteorological Satellite and its ground command, control and communication network; continued procurement of improved Navstar Global Positioning System satellites and continued development and test of the Nuclear Detonation Detection System user terminals along with acquisition of the operational satellite segment.

Our theater forces still remain a key deterrent to aggression by the Soviet Union and her allies. The numerical advantage enjoyed by the Warsaw Pact has become even more ominous with the introduction of many Soviet technical advances in avionics, aerodynamics, and propulsion systems. To meet this ever increasing qualitative and quantitative threat, we are continuing our modernization programs in tactical aircraft; air-to-air missiles, air-to-ground munitions/missiles; battlefield management command, control, and communication (C^3) systems; defense suppression and electronic combat measures; theater nuclear capability; and chemical warfare protective systems and retaliatory weapons. We realize the importance of obtaining a balanced mix of offensive weapons, defense suppression weapons, C^3 and intelligence fusion information, and nuclear/chemical capability. The Fiscal Year 1987 budget request is designed to accomplish that mix without sacrificing the importance of readiness and sustainability.

Force projection is vital to our ability to deter aggression by displaying our readiness to use the correct force at the right time and the right place. Our three key elements of force projection are airlift, refueling, and special operations forces. Air Force airlift operates in conjunction with sealift and prepositioned war materials to provide the link between force structure and combat capability. With the final procurement of 21 C-5Bs in Fiscal Year 1987, we will have completed the major portion of our near-term airlift modernization that started in 1983. For our long-term requirements, we will complete full scale engineering development of the C-17 multirole airlifter in preparation for a 1988 production start. We will also begin the development and acquisition of two Air Force One replacement aircraft whose need was recognized by the last Congress. To complement our airlift leg of force projection, we have significantly increased our refueling aircraft fleet to support tactical as well as strategic readiness. In Fiscal Year 1987, we will complete our planned 60 KC-10 fleet with the purchase of eight aircraft and will continue the annual production of KC-135R re-engine kits to provide a 50% fuel availability increase to our primary strategic airlifters. To meet the threat of low level conflict, especially that posed by increased terrorist activity, we have started acquisition of additional MC-130H and AC-130H aircraft to supply airlift and accurate fire power in support of our special operations forces.

Supporting the development and production of our weapon systems requires extensive test and evaluation facilities. With the increased emphasis on testing, we plan to conduct several test range modernization and improvement efforts in Fiscal Year 1987.

Overall, this year's budget seeks to sustain positive growth in the future to meet our national security objectives and military strategy of deterrence and flexible response to hostilities. Through careful stewardship of public resources during the first five years of the Reagan administration, we have made significant improvements in force modernization, readiness, and sustainability. With improved acquisition techniques, we will continue to improve our military posture. We have developed a budget that strikes a prudent balance between research, development, test and evaluation, and procurement programs and takes into consideration competing military requirements and program priorities. Congressional approval of this Fiscal Year 1987 budget will allow us to sustain our past gains and meet the growing threat.

Biography
United States Air Force

Secretary of the Air Force, Office of Public Affairs, Washington, D.C. 20330

DR. THOMAS E. COOPER

Dr. Thomas E. Cooper is assistant secretary of the Air Force for research, development and logistics, Washington, D.C. He is responsible for conceptual efforts on major new programs and for formulating, reviewing and executing the plans, policies and programs related to research and development, logistics and acquisition. His responsibilities span all major mission areas, including assigned space programs. He also serves as the Air Force acquisition executive. Dr. Cooper assumed his present duties in January 1983.

Dr. Cooper was born May 31, 1943, in Lindsay, Calif. From 1961 to 1970, he attended the University of California at Berkeley where he received a bachelor's degree (with honors) in engineering-mathematics, and master's and doctorate degrees in mechanical engineering.

Following graduation Dr. Cooper was an acting assistant professor of mechanical engineering at the University of California, Berkeley, from 1970 to 1971. In 1971 he joined the faculty of the Mechanical Engineering Department at the Naval Postgraduate School, Monterey, Calif., and was promoted to associate professor in 1974. In 1975 he was awarded academic tenure and the school's John Schieffelin medallion for excellence in teaching.

Chosen to be a Congressional Science Fellow during 1976, Dr. Cooper spent the year serving on the professional staff of the Committee on Armed Services, U.S. House of Representatives. Following his fellowship year Dr. Cooper was appointed as a professional staff member on the Armed Services Committee.

During his tenure on the Armed Services Committee, Dr. Cooper worked on a wide range of research, development and acquisition issues, dealing with both strategic and tactical programs, and with all areas of basic and applied research funded through the Department of Defense. In addition he handled all intelligence-related military programs and was the committee's liaison at the staff level with the House Permanent Select Committee on Intelligence. He also had responsibility for space programs and command, control and communications issues. Dr. Cooper served as the principal staff member to the Defense Industrial Base Panel of the Armed Services Committee that highlighted many of the fundamental problems in the industrial base and played a major role in drafting legislation relating to multiyear contracting.

Dr. Cooper has also worked for Procter & Gamble Co., Aerojet General Corporation, the California State Division of Highways, and has served as an engineering consultant to the Lawrence Radiation Laboratory, Livermore, Calif.; the Naval Weapons Center, China Lake, Calif.; and the Naval Weapons Laboratory, Dahlgren, Va.

He is a member of the American Society of Mechanical Engineers, Sigma Xi, North American Research Society and Tau Beta Pi. In 1975 he was chosen as one of the "Outstanding Young Men in America", is listed in American Men of Science and Who's Who in the West, and is a graduate of Harvard's program on National and International Security Affairs.

Dr. Cooper and his wife Helen reside in Alexandria, Va. They have a daughter, Nicole.

Biography

United States Air Force

Secretary of the Air Force, Office of Public Affairs, Washington, D.C. 20330

LIEUTENANT GENERAL BERNARD P. RANDOLPH

Lieutenant General Bernard P. Randolph is deputy chief of staff for research, development and acquisition, Headquarters U.S. Air Force, Washington, D.C. He is responsible to the U.S. Air Force chief of staff for all U.S. Air Force research, development and acquisition programs.

General Randolph was born in New Orleans. He received a bachelor of science degree in chemistry from Xavier University of Louisiana, New Orleans. General Randolph earned bachelor (magna cum laude) and master of science degrees in electrical engineering from the University of North Dakota, Grand Forks, through the Air Force Institute of Technology program in 1964 and 1965, respectively. He completed Squadron Officer School in 1959; Air Command and Staff College as a distinguished graduate, concurrently earning a master's degree in business administration from Auburn (Ala.) University in 1969; and was a distinguished graduate of the Air War College in 1974, all at Maxwell Air Force Base, Ala.

His first assignment after completing aviation cadet training at Ellington Air Force Base, Texas, and Mather Air Force Base, Calif., was with the Strategic Air Command at Lincoln Air Force Base, Neb., from June 1956 to June 1962. He instructed and evaluated KC-97 and B-47 flight crews. While there he was a member of a select crew.

General Randolph attended the University of North Dakota until July 1965 and was then assigned to Los Angeles Air Force Station, Calif., as chief, on-orbit operations, Space Systems Division. He was next assigned as assistant deputy program director for launch and orbital operations and was responsible for all payload operations.

From August 1968 to October 1969, General Randolph attended Air Command and Staff College and Auburn University. He was then assigned to the Republic of Vietnam, as an airlift operations officer at Chu Lai and airlift coordinator at Tan Son Nhut Air Base. He was responsible for the total operation of about 50 C-7 and C-123 airlift sorties daily from Chu Lai and later coordinated the operations of all airlift control elements throughout the Republic of Vietnam.

Upon his return to the United States in November 1970, General Randolph was assigned to Headquarters Air Force Systems Command, Andrews Air Force Base, Md., as chief of command plans in test evaluation, and then as the executive officer to the deputy chief of staff for operations. He attended the Air War College, from August 1973 to June 1974.

Following graduation General Randolph returned to Los Angeles Air Force Station as director, space systems planning for the Space and Missile Systems Organization. In April 1975 he became deputy program director and later program director for the Air Force Satellite Communications System. He assumed responsibility for space defense systems at Space Division headquarters, Los Angeles Air Force Station in March 1978. In this capacity he managed a program to design and develop the United States anti-satellite system with its supporting surveillance, command and control, and survivability aspects.

From July 1980 to September 1981, the general served as vice commander of the Warner Robins Air Logistics Center, Robins Air Force Base, Ga. He then became director of space systems and command, control and communications, Office of the Deputy Chief of Staff, Research, Development and Acquisition, Headquarters U.S. Air Force. General Randolph returned again to Los Angeles Air Force Station as vice commander and deputy commander for space systems acquisition for Space Division in May 1983. In June 1984 he became vice commander of Air Force Systems Command, Andrews Air Force Base. He assumed his present duties in May 1985.

General Randolph's military decorations and awards include the Distinguished Service Medal, Legion of Merit with one oak leaf cluster, Bronze Star Medal, Meritorious Service Medal, Air Force Commendation Medal and Presidential Unit Citation Emblem.

He was promoted to lieutenant general June 28, 1984, with same date of rank.

General Randolph is married to the former Lucille Robinson of New Orleans. They have six children: Michelle, Julie, Michael, John, Liane and Mark.

GROUND WAVE EMERGENCY NETWORK

Senator STEVENS. Senator Proxmire.

Senator PROXMIRE. Thank you, Mr. Chairman.

Secretary Cooper, about the Ground Wave Emergency Network which the Air Force wants to build at a cost of $750 million, one of those towers will be built in Mequon, WI. Some people there are quite upset about the tower. As I understand, many other communities across the country are, too.

Certainly we ought to strengthen our command and control and communications capability. However, many experts in and out of the Defense Department have serious questions about why the Air Force is building this massive network of 130 radio sites which will all be vulnerable to attack.

Why is the Air Force building such a huge system which will likely not be survivable after the first few minutes of attack?

Why does it not concentrate on a more limited GWEN system to operate only in the first few minutes and then look for another system that would be more survivable?

General RANDOLPH. In fact, the Ground Wave Emergency Network is a limited system. As you may recall, and again I have to apologize, the numbers are classified, so I am not going to be able to give you the numbers, but we have provided that information to your staff, we reduced the number of nodes by 50 percent as we made this request for fiscal year 1987.

The reason why we reduced the numbers of nodes is because we recognize, No. 1, that the purpose of the Ground Wave Emergency Network is to give us an assured way to get the emergency action message out.

Senator PROXMIRE. Let me interrupt. I think you are talking about the initial deployment. I am talking about the network of 130 radio stations which I understand is not classified.

General RANDOLPH. Your information may be different from mine. I thought it was classified. That is the total number. The number is about in that ball park that you just gave.

At one point we had plans to have a much larger number. In fact, we had submitted that to the Congress. We have since reduced that to the number to which you refer.

TRIDENT II MISSILE

Senator PROXMIRE. Secretary Paisley, the hard fact of life is that the Gramm-Rudman plan is going to end up taking a healthy bite out of military spending. It appears likely there will be no growth in the defense budget next year, if you are lucky, and perhaps a real reduction if you are not.

With that being the case, this committee, like it or not, is going to have to trim big-ticket items that DOD would like to have, but that we cannot afford at this time.

Is the Trident II missile one of these items?

The Navy would like to deploy Trident II, but the Congressional Budget Office has noted if we delay deployment of Trident II until 1994 when the 15th Trident submarine enters the fleet, we could save $1.4 billion over the next 4 years.

What do you think about such a delay, given the budget constraints we are under?

Mr. PAISLEY. Let me give you a general statement on that, then I will have the program manager, Rear Adm. Ken Malley talk to this. Let me first make a general comment about cuts.

As you know, we always have great difficulty bringing you a priority list, so I will make one general statement.

The Trident program is the No. 1 priority program in the Department of the Navy.

The second comment I make is that you should think a lot before you ever cut any program that we have that is on fixed price. We have fixed-price programs and those programs can be disrupted to the point where they will cost you a lot more money. This program is not on the same cost structure and I want to have Ken explain that to you.

Let me again state that the Trident program is the No. 1 program prioritywise in the Navy today.

Senator PROXMIRE. I agree with that. I am for the Trident all the way. I think it is an essential weapon system, probably the best we have as a deterrent.

My question, however, of course, relates to whether or not a delay would be sensible?

Mr. PAISLEY. Sure.

I would like to have Ken talk a bit about that.

STATUS OF TRIDENT PROGRAMS

Admiral MALLEY. My comments on the delay of the D–5 program are basically as follows.

Let me start by stating the D–5 development program is in the third year of a 6-year development program. We are more than halfway through in our RDT&E expenditures. We are about ready to start the fiscal 1987 production of the first missile buy.

Our facility at Kings Bay is well under construction to meet the December 1989 IOC. The Trident I, C–4 program is out of production and has been out of production now for several years.

To delay the program at this point would basically stop the D–5 program that is ongoing. To restart and basically redevelop the C–4 missile and weapon system in order to get missiles to put on those submarines, we would have to take up to five Trident II submarines that are under construction that are D–5 capable, rip out the D–5 equipment, restart the C–4 production lines and reinstall it at massive delay in time and effort at Electric Boat and we would have a number of submarines around for a number of years with nothing to do with them.

It is not a smart thing to do. It will cost a lot more money and there will be a lot of assets sitting around of no value to the country.

Senator PROXMIRE. Thank you.

EFFECT OF NASA LAUNCH FAILURES ON STRATEGIC PROGRAMS

What effect will the recent failures of the NASA launch vehicles have on our strategic program, including early warning capabilities, intelligence checks and research and development activity?

Can you give us an unclassified assessment of that problem?

General RANDOLPH. Yes, Senator.

First of all, of course, the shuttle is our primary concern because we, as you know, rely on the shuttle as our primary launch vehicle. With the approval of the Congress, we are now proceeding with what is called the complementary expendable launch vehicle which will allow us to provide some additional support and to do launches over and above those required by the shuttle.

The short answer to the question as to the impact on national security is that for the next 12 to 18 months we are going to be in a very difficult situation. We have assets on orbit, as you know. Those assets are good. As long as those assets do not fail, we can handle this problem.

If we begin to get failures on orbit, then we will have a very difficult situation. There is really no way for us to adjust to that situation in the near term. We believe, (*a*) our constellations are robust and, (*b*) we are working very hard so that when the shuttle is ready, that we are ready to work with NASA and to make sure that the complementary expendable launch vehicle is ready to launch toward the end of calendar year 1988.

Those programs are going along quite well. We appreciate the support of the Congress in the reprogramming on the complementary expendable launch vehicle because it is critical to the health of that vehicle and it will be critical to us for a number of years in the future.

AIR DEFENSE INITIATIVE

Senator PROXMIRE. Secretary Cooper, in the May 4 issue of the Washington Post, General Robert Herres, Chief of the U.S. Space Command, said that the Air Force has launched an air defense initiative. That new air defense initiative was new to me. I see no mention of this in the Air Force research budget.

How much does Air Force propose to spend on ADI in fiscal 1987? Can you give me an idea of what you will be doing in this program?

As I understand it, ADI will conduct research into defenses against bombers and cruise missiles.

Dr. Cooper. Let me ask General Randolph to respond to that part of it, but another part of the air defense initiative is the competition—I thought that was what you were referring to, for the new air defense fighter.

Was that the thurst of your question where we have currently ongoing the F-16 and F-20?

Senator Proxmire. No.

STRATEGIC DEFENSE ARCHITECTURE 2000

General Randolph. Senator, on the air defense initiative, actually that really takes a number of technology lines that have been ongoing for a number of years and as part of the thing called strategic defense architecture 2000. I think we have reported strategic defense architecture 2000 to the committee previously, that takes a look at things such as cruise missile detection, detection of bombers, how do we react to that, what are the warning systems. Also, what are the kinds of technologies we need to support those things in order to put together a comprehensive program to propose to Congress.

So, the air defense initiative is probably a little bit ambitiously stated. It is a technology program which will result in proposals to the Congress.

Senator Proxmire. My time is up. Thank you.

Senator Stevens. Senator McClure.

Senator McClure. Thank you, Mr. Chairman.

B-1A/B-1B SIMILARITIES

Is the B-1A different from the B-1B in that it is substantially designed and in particlar has different engine intakes and wing edges?

Dr. Cooper. That is correct. The B-1B does have those changes and it has a lower radar cross section than the B-1A.

Senator McClure. Is the designation B-1B justifiable because it has functionally related observable differences distinguishing it from the B-1A?

Dr. Cooper. I do not know the answer to that question, Senator.

General Randolph. The answer is yes, sir, definitely.

Senator McClure. Did the B-1A ever test launch an ALCM between 1973 and cancellation of the program in June 1977?

General Randolph. Not to my knowledge.

Senator McClure. Does the Air Force plan to test air-launched cruise missiles ALCM-B and ACM on a B-1B in September?

Dr. Cooper. Yes, we do. I do not know if the September date is correct. It is our plan to test both the ALCM and ACM on the B-1B.

Senator McClure. Are there any observable differences on the B–1B ALCM test program?

Dr. Cooper. Yes, there will be.

Senator McClure. Once this test occurs in September, or whatever the date may be, how many B–1B's will be operational?

Dr. Cooper. We currently have six at Dyess. As of September, we will have 15. That is when we meet our IOC. We may, in fact, have one or two more.

The plan right now in September is to have 15 B–1's operational.

ALCM-CARRYING B–52 BOMBERS

Senator McClure. How many B–52's will be ALCM carriers in September?

Dr. Cooper. Senator, we have 96 B–52G's that are currently equipped to carry ALCM's. At that point in time we will be nearing 30 B–52H's which will put us right about the limit under the no-undercut policy with SALT.

Senator McClure. You will have 110 to 120?

Dr. Cooper. We can have up to 130 B–52's that can carry cruise missiles.

Senator McClure. Will the whole class of B–1B's immediately count as ALCM carriers under SALT II when the test occurs?

Dr. Cooper. No, sir, just those, we call them externally observable differences, EOD's. Those will count. Those that are not equipped to carry cruise missiles will not be counted.

Senator McClure. Will the United States, therefore, go over the 120 SALT II ceiling of allowed ALCM equipped bombers when the B–1B tests ALCM's in September?

Dr. Cooper. I believe the limit, Senator, will be 130. Let me just say for the record, I am not an expert on arms control, that is not my business, but, as I understand it, under SALT we can have a total of 1,320 MIRV'd strategic nuclear vehicles.

When you count our SLBM's and our ICBM's, we will have 1,190. That will leave 130 bombers that could carry cruise missiles.

Senator McClure. Your calculation is different from mine. That makes the assumption that two Poseidons are scrapped?

Dr. Cooper. That makes that assumption, yes, sir. At that point in time whether or not we go over the limit is a decision that the President will have to make in consultation with the Congress.

Senator McClure. The Air Force and SAC oppose the September B–1B ALCM test. Is that not correct?

Dr. Cooper. No, sir. The Air Force supports testing both the ALCM and the ACM on the B–1.

Senator McClure. Is that your position or the Air Force position?

Dr. Cooper. That is the Air Force position. The official Air Force position is that we support testing ALCM's and ACM's.

OBSERVANCE OF UNRATIFIED TREATIES

Senator McClure. I will follow with a great deal of interest, as you know, the decision that is made and announcement that the President will make with respect to the no-undercut policy because I think we are flirting with disaster if, as a matter of fact, we decide that the Congress of the United States does not count the treaty ratification, we will go ahead and observe treaties even though the Senate will not ratify it.

I think that is where we are right now. I assume the President has the authority, although that may be constitutionally challenged on the basis of failure to submit a treaty for ratification.

The policy question, which I know you do not control, but you certainly have some input into it, disturbs me from the standpoint that the Soviet Union will be given the opportunity to determine what portions of a treaty it will comply with and what it will not.

The Congress has spoken on that repeatedly in favor of requiring their compliance with the treaties. The Jackson amendment, which is still the law of the land, says we should not adopt treaties which are disproportionate.

Certainly the observance of a policy that is disproportionate would also fall within the spirit of the Jackson amendment.

The Congress has also spoken with respect to proportionate response to Soviet violations and yet I do not see anything in the administration so far that carries out any of those policy choices, none of them.

I think it is not only getting to the point of being ridiculous; it is also extremely dangerous to the security of our country.

I know you are not the right people to answer this question, but it is in the strategic area primarily.

There is also a provision in law requiring a report on the security implications of treaty violations. That report is long overdue. At some point the administraton is going to have to come to grips with that question instead of temporizing and delaying the Poseidon scrapping decision, if indeed that is what it is.

I read in the press it is temporizing further. To what end, I do not know. Frankly, I think the Poseidon is one of the most survivable systems we have.

I want to tell you right now I do not think you are going to get the second 50 MX missiles, Congress is not going to vote it. If the administration believes they are buying some votes for the second 50 by a no-undercut policy, I think they are whistling Dixie. As a matter of fact, as far as I am concerned, the Poseidon out there on patrol is more survivable than the MX in the current silos.

I do not know what we are buying or what we are paying for. This Senator has always supported the MX program. I am going to question my continued support for it if we are scrapping survivable systems for ones of questionable survivability.

MIDGETMAN MISSILE

I think another question that I am going to have to look at is the Midgetman. I question the utility of a Midgetman. How many do you plan to deploy?

Dr. COOPER. We have not finalized on a number, Senator. For just general planning purposes, we have been talking about 500 SICBM's in concert with 100 MX's. But depending on where we end up with MX and where we end up in the SALT issue, that number is open to revisit.

SHIPMENT OF NUCLEAR MATERIALS ON RAILS AND HIGHWAYS

Senator McCLURE. Have you looked at the public reactions to the shipment of nuclear materials on railroads and highways?

Dr. COOPER. That is always a difficult problem. We have not had adverse public reaction yet to any significant degree to the small ICBM.

Senator McCLURE. You have not deployed one yet.

Dr. COOPER. No, sir.

Senator McCLURE. You will not have any objection to it until it is ready to go on the road.

Dr. COOPER. That is always a concern, yes, sir.

Senator McCLURE. If, as a matter of fact, you can anticipate that objection before it is deployable, you might save yourself an awful lot of money.

Dr. COOPER. As you probably know, though, our current plan does not envision, at least in peacetime, deploying the small ICBM on public highways. It will have that capability, but we plan to garrison it on DOD and DOE lands.

Senator McCLURE. My time is up. Thank you very much.

Senator STEVENS. Thank you, Senator.

Gentlemen, this budget is going to be one that is a very difficult one for us. I want to assure you we are going to have to get some answers and I appreciate what you say, Secretary Paisley, about answering questions now rather than waiting for the record. It is very much to our advantage to have answers to see if we have any further questions on them.

The Navy has budgeted a different amount for Trident. You have dropped the production continuity program that we put up $205 million for last year as requested.

FUNDING CHANGE FOR STRATEGIC PROGRAMS

What was the original impact of that change and what was done with the money we have put up already?

Mr. PAISLEY. I want to have Rear Admiral Malley talk about it.

I have followed strategic programs for over 30 years because I was deeply involved with Minuteman when I worked at Boeing. I can say the two strategic programs——

Senator PROXMIRE. Will you talk a little louder?

Mr. PAISLEY. Absolutely.

I was working on Minuteman when I was at Boeing, so I am very familiar with that strategic system. Through that entire period I followed the Navy development in the strategic area.

I do not think there are any programs in the Government that are run any better than the strategic program. I can say firsthand that the Navy strategic program is probably the best run of any program I have ever seen in the Government. It is a well-run program. That is No. 1.

One of the reasons it is that way is that we take great care in implementing everything that is required, not only to meet the goals, in this case, range and accuracy—but we take all necessary precautions prior to putting that system into production.

The cut you are talking about, which Rear Admiral Malley will address, came out of the Department of Defense and not from within the Navy.

Senator STEVENS. What happened to the money? Did you reprogram it?

Admiral MALLEY. You asked two questions. One, what was the operational impact and, two, what did we do with the money? I assume that you mean the 1986 money?

Senator STEVENS. Right.

Admiral MALLEY. The operational impact, as I envision it today, is that I have a potential for decreased reliability on the Trident II program. The Production Continuity Program was devised after the review of how we did on the Poseidon, C-3 program.

We had to go back, you may recall, and return a lot of our C-3 missiles back to the land and reconfigure them, redo some of the packages and send them back to sea. As a result of that, the Secretary of Defense asked my predecessor three times removed, Admiral Levering Smith, what can you do on future programs to preclude that problem from happening.

We invented the Production Continuity and Life of Type Program. So, looking at how well we did on the C-4 compared to the C-3, I made an estimate there would be a strong potential for degradation in reliability. I cannot talk about the exact numbers in open session.

So, I will not know the operational impact, the reliability impact, until we get to operational testing in the 1991, 1992, 1993 timeframe.

Senator STEVENS. I have only 10 minutes. I would appreciate it if we can keep the responses as short as possible so that we can get to some of the questions we have in mind.

FUNDING FOR GUIDANCE SYSTEM

Was that $200 million moved over to the guidance system? You had an increase from $22 million to $222 million.

Admiral MALLEY. You are now talking of the fiscal year 1987 budget?

Senator STEVENS. That is right. That is a dramatic increase in that one item, but you dropped the other. It tallies out with the dollars.

Admiral MALLEY. The 1987 budget in 1986 in our submittal would have been 1,863 or $1.8 billion. The way it is now being submitted, it is about $1.4 billion.

What we have done with the loss of production continuity and life of type, we have recategorized how we charge things and what we call them. As a result, because the guidance system is really almost a 3-year lead time system versus a 2-year lead time, like a missile, the way the money gets calculated is toward the guidance system.

So, a great majority of it now gets attributed to the guidance system. We have been working with your staff on this question and I am preparing some information for them which they should be getting in a couple of days.

It is a long, involved system. It almost takes a certified bookkeeper to track it through.

Senator STEVENS. We will look forward to the discussion.

TRIDENT II

On Trident II, CBO did a study indicating $4.1 billion would be saved by reducing the test program by 105 missiles with no serious damage to accuracy.

Your comments do not seriously disagree with those conclusions. They tell us, based on a slight change in accuracy estimating, some 3-foot difference, and minor changes in other concepts suggested by CBO, that we could save $4.1 billion on the test program alone.

In view of your production concepts for 66 missiles next year, what would be the impact on your program if we reduced that to 60 and saved $200 million, the cut we have to make right there.

Mr. PAISLEY. Let me make a quick comment. Our biggest problem these days is people making studies and giving results who do not know what they are talking about. I have an open door for anybody who wants to talk to me on this subject.

Senator STEVENS. Why did you not tell them you disagreed with their comments?

We take those CBO analyses very seriously up here.

Mr. PAISLEY. I thought we did in the form of an information paper in March in response to an inquiry from the committee staff in late February.

REDUCTION IN TEST PROGRAM MISSILES

Senator STEVENS. We do not think you did. If you want to, I suggest you go back and do it again. On the basis of what we have now, we have to take some money out somewhere and that CBO analysis says $200 million could come off that and you would certainly have a decent test program with 60 rather than 66 missiles.

Admiral MALLEY. When the CBO study was made, we were going to be procuring 27 missiles in fiscal 1987. We have been cut by OSD to 21 missiles in fiscal 1987. Now I have hardly enough missiles to make the IOC of Trident II with a full outload of missiles.

If we were to reduce the number of OT missiles in our program—actually it is FOT—if you look at the CBO study, he says reduce the OT's from 40 to 36 missiles. He is talking about the FOT missile reduction. Those missiles will not be in our budget until 1992. It is not a near-term reduction that can be made, sir.

Senator STEVENS. Do you have any better ideas?

The no-cut idea is gone. We lost that fight in the budget. Something is going to come out of the Trident program. That looks to us as a good place to do it, to reduce the test missiles by six.

If you have any other suggestions, we will be happy to get them.

Admiral MALLEY. I am not buying six missiles in this current budget. If I were to lose six missiles, I would have six fewer test missiles for outload in the first Trident submarine.

Senator STEVENS. It is the advance procuremen we are talking about.

Admiral MALLEY. The advanced procurement does not tie in with the test missile program at all, sir.

In my advance procurement line I am not buying missiles to make outloads. I am buying items that are long lead away and it is primarily the guidance system.

CBO SAVINGS ESTIMATE

Senator STEVENS. We will discuss it again. It is not my understanding of what the CBO estimate is in terms of their savings. They say that $4.1 billion is the total saving.

Admiral MALLEY. I cannot track the numbers.

Senator STEVENS. Do you disagree with that?

Admiral MALLEY. Yes, sir, I disagree with it.

Senator STEVENS. I do not agree entirely with what my friend from Idaho has said about the concept of the Poseidon. I do think he has a point about the MX. I, too, think it is going to be a very strange conclusion to see the Congress reverse itself and lift the cap of 50 on the Peacekeeper.

Under those circumstances, General Randolph, what is the most efficient way of making up for the 500 warheads that would not be used if we had the 100 MX's?

Dr. COOPER. Are you speaking in the ICBM force, Senator?

The only alternative we have then is the small missile.

Senator STEVENS. That is right. I assume it is the small missile. I assume we would have to increase the Midgetman program if we stayed with the single warhead.

Dr. COOPER. You would have to increase the total numbers, but, of course, you would not realize the increased missiles until the end of the buy.

What we have is a near-term capability for 500 or 1,000 warheads that we would have with MX, those second 50 reaching 500. That is a capability we could have on line in the near term.

If you replace the second 500 warhead capability with the small ICBM, you really will not replace those warheads until the end of the buy. That is sometime later near the 1990's when that will occur. That is not a good option for at least the next half decade or so.

Senator STEVENS. Senator Johnston.

Senator JOHNSTON. Thank you, Mr. Chairman.

ATB AIRCRAFT

First of all, General Randolph, this is three questions in one. Is not ATB on line, all of the challenges of development being met? I say on line, I mean developing well in that the Air Force is as determined or more determined than ever to fund the ATB and to terminate the B-1B program at 100 bombers?

Dr. COOPER. Let us give you a simple declarative yes on that, Senator.

MX VULNERABILITY

Senator JOHNSTON. Second of all, I want to agree with what my friend from Idaho and the chairman said about the MX being totally vulnerable.

Mr. Paisley, you talked about the strategic programs of the Navy. I have to agree with you they are very well developed. If you were Secretary of Defense and had to make the decision whether to go to the MX missile and put it in the Minuteman silos or rather to develop more D-5 missiles or more Trident II submarines, what would your choice be and why?

Mr. PAISLEY. Let me make one statement. We operate the strategic Triad in three different media: the Earth, the air, and the sea. The strategic Triad is based on that capability. If the Soviets can counter something unique to any one of those systems, then there are two left.

I am in no position to judge which way we should go.

Dr. COOPER. He has my vote for Secretary of Defense, Senator.

Senator JOHNSTON. It had not occurred to me that MX made any sense to put it in the Minuteman silos. I think that is a silly deployment. I do not understand it at all. I understand the reason why you do not want to answer that.

Following up on Senator Proxmire's question——

Dr. COOPER. Senator, can we discuss that or do you just want to make that as a statement?

STRENGTH OF TRIAD

We would like to say that we disagree with that because the strength of our nuclear deterrent is the Triad.

If you put yourself in the position of the Soviet, the problem he faces is not taking out an MX missile in the silo, it is taking out all three legs of the Triad together with the command and control system. I think the three legs compound and confuse him to a point that it would take a fool to try to launch a preemptive strike against that defense force.

Senator JOHNSTON. You are correct, it would take a fool to do that. The question is where do you put your scarce resources? Do you put them down in a vulnerable hole, with the so-called window of vulnerability, to begin with, or do you try to do something better, whether it be a Midgetman, whether it be Tridents or whether it be an air-launched cruise missile or ATB, or whatever? I think our resources are scarce.

AIR DEFENSE INITIATIVE

Secretary Cooper or General Randolph, following up Senator Proxmire's questions about the air defense initiative, is it the plan of the Air Force or the space command, or whatever, to submit a plan for an air defense intiative which would make the United States relatively invulnerable to cruise missiles or bombers?

General RANDOLPH. Senator Johnston, I do not think we want to make a statement like that. It is a plan to look into the technologies to determine what is technically feasible by way of protecting the United States against the air-breathing attack, the cruise missiles in particular.

As you are aware, detecting, tracking and interdicting cruise missiles is a very difficult task. The question is what are the options that are available? So, our plan to the Congress when it is ready to lay out an architecture, some kind of structure, and the technologies necessary to be pursued in order to implement that structure.

Senator JOHNSTON. Do you plan to recommend it?

I say that because General Herres, Chief of the Air Force Space Command, was quoted in an article as saying:

"It is going to cost a lot of money to build an air defense system that is anywhere near leak proof."

If you take that quote literally, it indicates an intention to go ahead and recommend an architecture that would achieve that purpose.

The question is: Are you just sort of looking at many options, what it would cost, or are you really going toward a recommendation of deployment as, for example, I think we made the decision, I think the Department of Defense has made the decision to go ahead and deploy by whatever architecture the SDI.

Have you made the same kind of decision with respect to ADI?

General RANDOLPH. First of all, I am unaware of any decision to go ahead and deploy SDI. As I understand it, SDI is a technology program.

With regard to the ADI, what we are doing is trying to put together a plan to propose to the Secretary of Defense as to where do we go from this point forward in order to enhance our continental U.S. air defense capabilities as well as the total——

Senator JOHNSTON. I am not suggesting SDI had been decided for deployment, but certainly we have decided to spend $26 billion, whatever the figure is, to make the development decisions in the early 1990's.

Have you matured that much with respect to ADI?

SDA 2000

General RANDOLPH. No, sir, we have not matured that much. As I mentioned to Senator Stevens, we have this thing called Strategic Defense Architecture 2000 which is an ongoing study which is designed specifically to look at options, the technologies that support those options and, therefore, develop a proposal to give to the Secretary of Defense and ultimately to the Congress on how to proceed.

Senator JOHNSTON. So, that article in the Washington Post would at least given an impression, more impression than was intended with respect to ADI. Did you read the article?

General RANDOLPH. Yes, sir, I read the article. I would have to say the article was somewhat overstated.

Senator JOHNSTON. OK, that is good. Of course, you have no idea what the anticipated cost of SDI would be. It seems to me former Secretary Schlesinger said it might cost up to a half trillion dollars.

Do you have any idea?

General RANDOLPH. No, sir, no ball park figure.

Dr. COOPER. I think if you go back to the 1960's when we abandoned air defense, the reason we abandoned it is the Soviets got ICBM technology and we got MIRV technology.

The conclusion was if we could not protect against an ICBM attack, it did not make a lot of sense to spend a whole lot of money on air defense.

We went from a posture of robust air defense to maintain warning and prevent a free ride. Now that we are emphasizing SDI and getting back into the defense against ballistic missiles, we think we also need to start looking at what the counterpart to that would be in the air defense arena. That has followed the President's emphasis on SDI.

Senator JOHNSTON. The reason being it would not make any sense to build an SDI if you had bombers and cruise missiles that could come in?

Dr. COOPER. That is right. What we have tried to do now is posture ourselves so that at a point in time when we deploy an SDI, if we deploy an SDI, we can have a counterpart in the air defense world. I agree that would be expensive, but I also think the technologies there are less stressing than they are in SDI.

I think we can get up to speed there faster. It does not give me a lot of problems if we lacked a couple of years looking back at air defense. That is where we are right now looking at a counterpart of SDI in an air defense world.

Senator JOHNSTON. Is it fair to say that if a development decision is made for SDI, that you would expect also simultaneously on in the same track a development decision for ADI because it would not make any sense to have SDI without——

Dr. COOPER. I could not prejudge that. The Air Force wants to be in a position if that were the decision by the President, we would have a system that we could propose.

Senator JOHNSTON. Thank you, Mr. Chairman.

Senator STEVENS. Senator D'Amato.

PREPARED STATEMENT

Senator D'AMATO. Thank you, Mr. Chairman. I ask that my prepared remarks be placed in the record as if read.

Senator STEVENS. Without objection.

[The statement follows:]

PREPARED STATEMENT OF HON. ALFONSE D'AMATO

U.S. SENATOR FROM NEW YORK

Mr. Chairman, I want to thank you for holding this hearing today to review our strategic programs. Our strategic systems are the foundation of our national security policy and deserve our close attention.

I also want to thank our witnesses, Dr. Thomas Cooper, Assistant Secretary of the Air Force for Research, Development, and Logistics; Melvyn Paisley, Assistant Secretary of the Navy for Research, Engineering, and Systems; and Vice Adm. Albert Baciocco, Director of RDT&E for testifying today. I look forward to their testimonies.

The importance of our strategic systems is highlighted by the relentless growth of the Soviet's strategic modernization efforts. The development of the SS-24 ICBM, the deployment of the SS-25 ICBM, the Blackjack supersonic intercontinental bomber, the SS-NX-21 small cruise missile, and other strategic weapons development reflect the continued Soviet commitment to strategic modernization efforts.

The United States has always held a qualitative edge over Soviet-made weapons. The importance of keeping this qualitative edge for our strategic forces cannot be underplayed. Although we continue to hold this edge for each leg of our triad strategic deterrence system, the gap is narrowing.

What the Soviets lack in technology, they make up in numbers. For example, the Soviets maintain the world's largest ballistic missile submarine force with 62 modern nuclear-powered vehicles, compared to 37 for the United States. That is why it is so vital that we support the President's strategic modernization program. To scrap or delay parts of this program will lead to a very serious deterioration in the credibility of our strategic deterrent.

U.S. strategic deterrence in the nuclear age can fail only once. While Congress may be able to help the Defense Department eliminate waste and fraud to reduce costs, it would be shortsighted to weaken in any way our strategic deterrence. I look forward to working with you, Mr. Chairman, Dr. Cooper, Mr. Paisley, and Admiral Baciocco, toward keeping the deterrent value of strategic forces strong.

Thank you, Mr. Chairman.

DISMANTLING OF MINUTEMAN LAUNCHERS

Senator D'AMATO. General Randolph and Dr. Cooper, a well-respected member of the Senate Armed Services Committee recommended to the President that to stay within SALT II limitations that we should possibly dismantle 22 launchers for Minuteman III ICBM's rather than dismantle two Poseidon submarines.

Can you tell me why this is or is not an attractive option?

Mr. PAISLEY. If Dr. Cooper does not mind, I think I would like to have Capt. John Huling talk about this. John works in the Office of the Chief of Naval Operations. This is an area that he continually monitors. I would like you to understand it completely from our viewpoint

Captain HULING. Senator, we prepared for Poseidon as we were directed by OSD. We were directed by the President through our chain of command to be prepared to dismantle the Poseidons.

We are prepared to dismantle them if the decision is final red to dismantle. The Navy was not told to look at options for other systems.

Senator D'AMATO. Has anybody looked at options that would keep us within SALT II, but might provide us with a better strategic capability?

Mr. PAISLEY. Senator, you are probably talking to the wrong group. Let me make a point or two.

Senator STEVENS. I point out to my colleagues that the Secretary of Defense will be our windup witness. We did not have him first. We will have him last.

Those sorts of questions I think can be kept for him and his staff when they do get here later this month.

Senator D'AMATO. Has anybody here been involved in that decision?

Mr. PAISLEY. One thing we did do, we supplied to the Secretary of Defense's Office the status in terms of all of these boats, in terms of the life of the boat and how much work we would have to put into them to refurbish them.

Yes, we did participate in that sense. I do not know that we participated in the decision on what you do in terms of the mix between the Air Force system and the Navy system, but we gave the Department of Defense the data associated with submarines.

We are prepared to implement any program that the President decides on: to keep them or refurbish them. Not all these options are as simple as I state them. The boats we are talking about are getting pretty old. So, we did do that, to answer your question.

Senator D'AMATO. You did part of that. You did not make an analysis with respect to the possibilities.

DISMANTLING LAUNCHERS

Do you care to comment on dismantling launchers as opposed to the Poseidon submarines?

Mr. PAISLEY. No, not at all. I think the chairman has exactly the point. The focal point of this sort of decision in the Department of Defense is the Secretary of Defense and he is the one you should ask that question.

Senator D'AMATO. I understand that.

Mr. PAISLEY. I do not have a comment.

Senator D'AMATO. I will pursue that.

Dr. COOPER. Sir, can I make a comment on that?

Senator D'AMATO. I have one for you, too.

Dr. COOPER. I want you to know that under the no-undercut in SALT, we can deploy 1,200 SLBM's plus ICBM's. We have 550 Minutemen deployed today. The balance of 650 are in the boats.

The thing that causes us the headroom problem is the No. 8 Trident that is coming into the inventory. I have not been party to the decision. They have not asked my opinion.

What you can see is, if the Poseidons do come down, they are being replaced by another SLBM system. As we deploy MX, we are not deploying MX in addition to the Minuteman III. We are dismantling Minuteman III one for one as we deploy MX.

DEPLOYMENT OF MX

Senator D'AMATO. You said as we deploy MX.

Is that for testing?

Dr. COOPER. We are deploying 50 and in fact we will deploy the first one in September of this year. It is a one-for-one replacement. As we deploy MX, we will take down Minuteman III. We are dismantling Minuteman III as we put modern systems in the inventory.

FUNDING FOR MX

Senator D'AMATO. How much are we spending on MX in 1987?

Dr. COOPER. $1.8 billion is our request. That is for the R&D program and for procuring 21 test missiles. We are not requesting operational missiles this year. Congress has told us we have to find a more survivable basing mode.

Senator D'AMATO. I think you are going to have a lot of trouble getting that money.

Dr. COOPER. I agree with you, Senator, it has been a struggle.

Senator D'AMATO. It is going to be harder than you think. If indeed we do not move forward with testing, would not that be a waste of money?

Dr. COOPER. With testing?

Senator D'AMATO. Yes.

TESTING OF MX

Dr. COOPER. In my opinion, we have to go forward with testing whether you deploy 1 missile, 50 missiles or 100 missiles. It makes no sense at all to deploy the missile and not test.

Could I give you some statistics, Senator?

You talk about it is going to be a struggle. We have yet to have our total MX request supported. It has been cut every year by the Congress. We now find ourselves in a posture where the 50 missiles we are going to deploy in existing Minuteman silos are going to cost more than the original MX program in silos because of the cuts we have taken. We are producing at very inefficient production rates.

Senator D'AMATO. Maybe we should close it down. After all, there are other situations in which the out-year production of various aircraft are being terminated for lack of funding. That does not make sense economically at that point. Maybe we should close the MX line, close the line down. Then we could afford to fund the procurement of these needed aircraft.

Dr. COOPER. To deploy the current missiles we are authorized to deploy, and not buying test missiles is like buying aircraft and not test flying those aircraft.

Senator D'AMATO. My time is up. You can see the line I am pursuing.

Dr. COOPER. This year we are requesting 21 which Congress limited us to last year in the report. That is not the economic production rate; 48 per year is.

Senator D'AMATO. That was a very pretty close vote, too.

Dr. COOPER. It was a very close vote. We have got ourselves in a position now where going forward is very expensive because we are producing these things at an inefficient production rate.

Senator D'AMATO. Maybe there is a point in time when we should reevaluate the program. Maybe we should not go forward, especially considering the $1.4 billion being requested for MX in fiscal year 1987 under current Federal budget constraints.

Senator STEVENS. Senator Sasser.

Senator SASSER. Thank you, Mr. Chairman.

CURRENT FUNDING FOR ADI

Dr. Cooper, following up on the line of questions that Senator Johnston was pursuing with regard to the air defense initiative which is being contemplated to take on bombers and cruise missiles, is there any funding for the so-called ADI in the current defense budget and if so, how much is it?

Dr. COOPER. I do not have that number off the top of my head, but it is a very modest amount of money. As General Randolph says, I am not so sure I would dignify it by calling it an air defense initiative as if we were going to launch on a major counterpart of SDI in the air defense world.

We are looking at the problem right now to try to get a feeling for what the scope of it is.

Senator SASSER. Can you give us some idea of what a relative modest amount will be?

Dr. COOPER. I would say relative to SDI, it is a modest amount of money, but I certainly will get that answer for you.

[The information follows:]

FUNDING FOR ADI

The ADI was created by combining two existing sensor program elements [PE's] with two new PE's. The existing PE's, 63424F cruise missile surveillance technology and 63716F atmospheric surveillance technology, are developing cruise missile detection sensors required for the tactical warning mission whether ADI is deployed or not. However, these sensors are vital for ADI to be successful and are included within the ADI Program. The new PE's are 63368F air defense battle management technology and [deleted]. The funding contained within the defense budget for these four PE's is shown below

[In millions of dollars]

PE	Fiscal year 1987	Fiscal year 1988
63424F	16.9	26.6
63716F	32.0	30.6
63368F	2.5	10.5
[Deleted]	2.1	13.5

THREE-WARHEAD, 70,000-POUND MISSILE

Senator SASSER. Dr. Cooper, one of your colleagues, Dr. Hicks announced the formation of a group to study the feasibility of a three-warhead, 70,000-pound missile. Dr. Hicks has expressed the view before this committee that a three-warhead missile would have an advantage over the single-warhead Midgetman, No. 1, it would be just as survivable and that it would be cheaper than the Midgetman.

I was under the impression that Air Force studies had concluded that a 37,000-pound single-warhead missile is the correct path for achieving a survivable land-based ICBM.

Dr. COOPER. Actually, that conclusion came from the Scowcroft Commission, Senator Sasser. The Scowcroft Commission recommended a single-warhead small ICBM in the 30,000-pound class.

What Dr. Hicks believes, and that is what we are in the process of trying to verify, is that if you can produce a three-warhead small ICBM that maintains the mobility of the single-warhead small ICBM, then it would be more cost effective. The key there is the mobility.

If you can build a three-warhead missile that will be in roughly the 65,000- to 75,000-pound class, if it can maintain all the mobility of the 30,000-pound class single-warhead small ICBM, then I would concur that that would be more cost effective because you have the same cadre of people taking care of three warheads versus one.

The key there and what we are looking to see is what the impact on mobility is as you increase the weight of both the missile and the launcher.

Senator SASSER. Would you be calculating having the same number of three-warhead missiles as you would have single warhead?

Dr. COOPER. You would have approximately a third number of missiles for a given number of warheads as with the single-warhead small ICBM.

Senator SASSER. You would not be concerned about the fact the number of targets would be reduced by two-thirds if there was an effort made at a preemptive strike?

Dr. COOPER. That is the key, whether or not you maintain the mobility so that the Soviets do not know at one time where that launcher is. That really is the key to our analysis, what is the impact on mobility as you increase the weight?

COST DIFFERENCES BETWEEN SINGLE AND THREE-WARHEAD MISSILES

Senator SASSER. Has the Air Force calculated the cost difference between 500 single-warhead missiles versus, say 160 or 165 of the three-warhead missiles?

Dr. COOPER. We are in the process of doing that and that will be part of our analysis. It will not be one-third the cost. There are fixed costs that you are going to have regardless of how many warheads. It will not be linear in the sense that if you go to three, you will reduce the cost by a third, but there should be some significant cost reduction to go to three versus one or perhaps two versus one.

We are looking at that entire range of possibilities, a variety of two-warhead and three-warhead small ICBM's in different deployment modes.

Dr. Hicks has asked us to do that in preparation for the DSARC that is going to occur in December when we make a decision whether or not to enter full-scale development on the current small ICBM.

So, there is a decision there whether we continue down the current path or whether we go to a new concept.

Senator SASSER. Let me ask you this question.

DECEMBER 1986 TIMETABLE FOR MINUTEMAN

Does this feasibility study on the question of the three-warhead missile system endanger the timetable for the December 1986 decision date on whether to put the Midgetman into full-scale engineering development or not?

Dr. COOPER. Yes. I do not think there is any danger in meeting the December timetable. We anticipate we will have our analysis done, but if a decision is made and recommendation is made to the Congress that we change course and go to either a two-warhead small ICBM or three-warhead small ICBM, there will be some delay injected into the program.

We will have to do some redesign work on the hardened mobile launcher. If you go to weights in excess of about 40,000 pounds, you have to change the diameter of the missile. We are currently working on a 46-inch diameter small ICBM.

Certainly if we went to a three-warhead small ICBM, we would probably have to have a diameter on the order of 52 inches. That is a major redesign. There would be a delay of 1 to 2 years in the program.

Senator SASSER. Thank you, Mr. Cooper.

Thank you, Mr. Chairman.

Senator STEVENS. Senator Proxmire.

Senator PROXMIRE. Thank you, Mr. Chairman.

B-1B PROGRAM

Secretary Cooper, Secretary Weinberger recently wrote me saying:

> I do not envision any circumstnces that would necessitate a change in the current B-1 program. I am. opposed to buying any more B-1B's than the 100. We have no plans for the 101st B-1B nor do we have any funds in our future budgets for continued B-1B production.

Do you agree with each of these statements?

Dr. COOPER. Absolutely. Both professionally and personally.

Could I embellish on that, if I might?

We have only so much money to spend on bombers. We have ATB to the point that we are absolutely confident that we can develop and deploy it. It makes no sense to us in a constrained budget to spend insurance money on the B-1. What money we have for bombers we want to put on ATB.

Senator PROXMIRE. I appreciate that. In view of that, let me ask some specific questions. These are some points Rockwell makes.

First, because of the learning curve we are stopping B–1B production at its most economical production point. With full employment and full tooling, we should continue to use this hot production line.

Dr. COOPER. I agree with the first part of it. We are stopping it when it is at a very efficient production rate. That happens whenever you transition from one system to another system. We are interested in the new technology and more particularly what we are interested in is fielding the system that will meet the threats that we face in the 1990's. We think ATB is that system.

STEALTH PRODUCTION

Senator PROXMIRE. The second point is the B–1B is much cheaper to produce than the Stealth.

Dr. COOPER. I will simply say the 101st B–1 would be cheaper than any system that we would propose to put in its place. That is always the case when you buy the *x* plus one versus the first one. So, you have a disparity.

Senator PROXMIRE. What I am asking is whether the B–1B is one-half the price per unit that you will have with Stealth once the Stealth gets going and all the fixed costs?

Dr. COOPER. Without getting into the specifics, let me say that is not the case.

Senator PROXMIRE. Third, the B–1B already incorporates Stealth characteristics so we have a Stealth aircraft now and thus we do not need the ATB.

Dr. COOPER. It does incorporate very modest Stealth characteristics that are vey significant improvements over the B–52, but nowhere compared to the improvements we make with the ATB.

Senator PROXMIRE. Fourth, the B–1B production line is a national asset and should not be shut down in the face of Soviet cheating.

Dr. COOPER. ATB will be a national asset as well.

Senator PROXMIRE. Fifth, the Stealth aircraft or ATB will have less capability than the B–1 in terms of range and payload.

Dr. COOPER. Not true.

AIRCRAFT INSTABILITY

Senator PROXMIRE. Sixth, the ATB will be unstable in flight.

Dr. COOPER. Senator, I could answer those, but I think you are going to have a classified session. I would prefer not to go on the record publicly.

Mr. PAISLEY. Let me say something. I am sort of the unbiased witness.

I am very familiar with that program. I probably was involved in it, if not before Tom, at least about the same time.

There are many, many airplanes that are unstable if you do not have a flight control system in them, including many of our fighters. I will be frank with you, that question is a loaded question. It becomes an obvious situation. If you lose powered flight control in an airplane that is basically not stable, that will happen. It is as stable an airplane as any of them.

Senator PROXMIRE. I am not making a Proxmire argument. I am relating the argument of the people who are pushing this, the Rockwell people.

Dr. COOPER. I would make a point about unstable aircraft. The F-16 is an unstable aircraft. We do not have problems in flight today with the F-16 because it is a fly by wire and we control that electronically.

What that means, when it is unstable, if you did not control it and it pitched up, it would continue to pitch up. It would not have a tendency to come back down. That is not unusual with many of the aircraft we build today. We understand that technology very well.

I do not want to comment on ATB in open session. I think we will have a closed session.

Senator PROXMIRE. The seventh point made by the people who are lobbying for Rockwell is that the Russians will be able to use their older radar to detect the ATB.

Dr. COOPER. Let us get into that with you in a classified session because we would like to lay that out.

Senator STEVENS. I do think because of the comments we have been getting that we ought to schedule an ATB briefing. I prefer that it not be a hearing, but be a briefing off the record and have people ask questions to the extent you want to get into it. I do think it is essential we settle this a bit.

Dr. COOPER. General Randolph has an excellent briefing that addresses all the points plus others you brought up in your question. Let me say for the record, none of the questions that you have asked or any of the issues that we have seen brought up in the open press causes any concern whatsoever about the ATB.

In the face of all those, we have looked at them all, and we are as steadfast in our support of ATB today as we ever were.

Senator JOHNSTON. In that hearing, Mr. Chairman, if you could schedule the B-1 as well, it would be helpful.

Dr. COOPER. What we do in the briefing, and I think I can say this is on an apples-to-apples basis, we will show you on a unit cost basis what the first 100 B-1's cost per unit. We will then do likewise for a comparable number of ATB's and show you exactly what those cost comparisons are.

I think what you will see is the price we are paying for the ATB is not out of line with what we pay for the B-1.

STRATEGIC DEFENSE INITIATIVE

Senator PROXMIRE. The Strategic Defense Initiative envisions offensive arms reductions moving hand in hand with the deployment of an SDI system. Even if the Soviets do not immediately agree to offensive arms reductions, the belief is that SDI will be made so cost effective at the margin that we will deploy it even without arms control and thus force the Soviets to reduce their offensive force while they deploy their defensive force.

Then eventually neither side would find much use for offensive nuclear arms, so these stockpiles would whither away and we would enter the world of mutual assured survivability where both sides would rely on defensive systems instead of offensive systems.

The administration and SDI officials say unequivocally that this is how it is going to happen. This is their principal justification for spending such huge sums of money on SDI at this point.

Well, if that is the case, is the Department of Defense beginning to ramp down its development of offensive nuclear arms in preparation for the day when they will be "impotent and obsolete" as the President has stated?

Are we going to be seeing spending on offensive nuclear weapons taper off in the near term as spending on SDI increases?

The White House says offensive nuclear forces will become obsolete no matter what the Soviet response is to SDI. If that is the case, if that is now a given, should we not begin ramping down our spending on offensive nuclear forces?

Mr. PAISLEY. Let me make a brief comment on that. It is a technology program, as I understand it.

The Navy is involved in some segments of it. When that technology program gets to a point where it is very low risk or when it starts to get into long lead development, at that point in the program, then these questions are very germane. I think they are all premature at this time.

I do feel that they are good things to think about. But the question is premature, in my viewpoint.

Dr. COOPER. I would agree. I do not think we should abandon our offensive strategic systems until we know what the SDI system is. We do not know that today. It will be some time, I think, before we get to the point where we have a system that we can deploy that would lead us to back off our strategic defensive systems.

Senator PROXMIRE. General Abrahamson told this committee that the SDI is solving the technology problems.

Dr. COOPER. I did not hear.

Senator PROXMIRE. That the technology problems generally have been under control and it is simply a matter of proceeding to be in a position to deploy.

Senator STEVENS. The record will show that is an interpretative statement.

Dr. COOPER. I do not follow SDI as closely as Ed does. I guess I would have to disagree with that statement if it were made.

Senator STENNIS. I would like to place a question by Senator Rudman in the record.

Senator STEVENS. It will be included in the record at the conclusion of the hearing.

Mr. PAISLEY. There is one point I would like to make. We often get two subjects confused in our business.

One is called technology and the other is called development.

Most of the problems we people hear about in this room on programs are development problems, not technology problems.

The biggest problems in employment of a system are developmental problems. We have to have development problems well in hand before we think about cutting back on anything.

Senator STEVENS. Thank you very much.

Senator Chiles.

Senator CHILES. Thank you, Mr. Chairman.

C-17 TRANSPORT

Dr. Cooper, there are some people in Congress who seem to believe that budget constraints this year could force the Air Force to curtail its support for the C–17 transport. My understanding is that the C–17 is one of your highest priorities and, for that matter, enjoys a great deal of support among all the Joint Chiefs.

Could you please detail for me where the C–17 is on the Air Force list of priorities and comment on where it kind of stands on the Pentagon's list?

Dr. COOPER. Not to avoid your question, but it is high enough on our list of priorities that it is funded in the 1987 budget request. Right now it continues to be funded in the out-years.

At some point if budgeting is below a certain level, everything is rolled out on the table, but the C–17 is a very high priority program for the Air Force and strongly supported within the Air Force.

Senator CHILES. Thank you.

Thank you, Mr. Chairman.

Senator STEVENS. Thank you.

AIR DEFENSE AIRCRAFT COMPETITION

With regard to the schedule as far as the air defense aircraft competition, we have $200 million in the 1986 bill.

Dr. Cooper, several months ago the Secretary of the Air Force said he would let us know if the July 1 date for awarding that contract is still a viable date.

The Armed Services Committee is working on us to get us to agree to deauthorize those funds and change the award date to November and in effect slip the funds to another year. We have not agreed to that.

What is the Air Force's position with regard to slipping that contract award on that competition?

Dr. COOPER. Senator, we cannot meet July 1 as a contract award date. I believe the law last year said we had to make a source selection by July 1 and have a contract award within 60 days thereafter.

In point of fact, we normally make a source selection, if not on the same day, shortly thereafter we award the contract. The real issue is can we get on contract by September 1. Our judgment right now is no. We think we need another month. The bids are not yet in. We anticipate receiving the bids on May 9.

That is why we have refrained from getting back to you. We want to get the bids in hand and take a look at them. I thought the intent of Congress was to have us, No. 1, do a professional job on source selection and do it as fast as possible.

I want to assure the committee we are doing that. In my judgment, it would be a prudent thing to do to give us relief from a specified award date. Not only do we have to do evaluation, but the source selection authority needs decision time to consider the results of that.

Having said all that——

Senator STEVENS. What about the $200 million?

Dr. COOPER. I was going to say, having said all that, we do not need $200 million in last year's bill. Since Congress provided it for us in the 1986 bill, we have decremented that request by $200 million.

So, if you were to take the $200 million away from 1986, it would have to be added back to 1987 or at least that would be our recommendation.

So, we knew at the time when you gave us the $200 million we still had our 1987 budget in front of us and we decremented it by $200 million. I do not see any advantage. It is money in hand.

Senator STEVENS. I am glad to have that clarification and we will go back to our friends in the Armed Services Committee. I am sure they realize our budget problems in 1987 are greater than the ones in 1986.

Dr. COOPER. Yes, sir.

ADI PROGRAM

Senator STEVENS. In terms of ADI, I am getting vibrations that do not sound right. It is not related to SDI in the sense that it would not be something that would be examined if there were no SDI.

Am I hearing right now that you are saying that ADI is so related to SDI that it is the possibility of SDI deployment that requires us to have an ADI?

Dr. COOPER. I think we would always maintain an air defense. The question is: To what degree, how robust it will be.

Senator STEVENS. Robustness has something to do with the threat. We have an increasing Soviet threat of Bear-H's, a totally different threat in the sense that we can project changes for the 1990's without regard to SDI deployment on either side, can we not?

Dr. COOPER. Yes.

Senator STEVENS. I sense an inclination on the part of my friends to add the cost of the ADI to the SDI?

Dr. COOPER. No, sir.

Senator STEVENS. They are independent, are they not?

Dr. COOPER. Yes, they are independent. I will say this.

If we got to the point we could deploy a leak-proof SDI system, back to this question of reducing or eliminating strategic offensive arms, if we did not have some counter to the air-breathing leg, then perhaps they would concentrate on that part of that force.

At that time you would want to have a robust air defense system as well.

Senator STEVENS. If you lived where I live, you would not worry about SDI, you would worry about the increased number of Bear-H's coming across the Aleutian chain.

General RANDOLPH. We started the so-called SDA 2000 before the SDI program was initiated. It has been slow coming on. We have been doing the technology work. We have just pulled it together in a more cohesive program because of our concern about the Bear-H's and cruise missile carriers.

That is, indeed, a very strong concern of ours and we intend to try to do the best we can to counter that threat.

Senator STEVENS. Does it include an air defense anti-cruise missile capability?

General RANDOLPH. We intend to look at that.

Dr. COOPER. I might point out in the President's 1981 strategic modernization program the fifth part of that was to improve our defensive systems, both the warning system, the radar and also the air defense system and then SDI got added to that later, just to underscore General Randolph's points.

Senator STEVENS. To make the record clear, I have given Senator Johnston notice that we do have a scheduled date to go to the Pentagon to explore the whole question related to ATB and some of the representations that have been made. That will not be a hearing. It will be a meeting.

We will explore these with you there so that we can postpone those further questions if it is all right.

Dr. COOPER. We look forward to that, Senator.

MX PROCUREMENT

Senator STEVENS. I am equally concerned with others here concerning the MX and the level of procurement of MX's that is in the budget in terms of these test vehicles, $1.4 billion for 21 test vehicles.

CBO has recommended to us in light of fiscal constraints, that we reduce that operational test program.

Have you made any recommendations to the Authorization Committee along those lines?

Dr. COOPER. No, sir. In fact, we think the MX test program is very austere. The points I would make if you were going to reduce the test program, you would not reduce it on the front end optimally. You would reduce it on the back end.

All that would happen now if you reduce our missiles is that the unit cost goes up. If you go from 21 to 12 missiles this year, you increase the unit cost of the missile by 25 percent.

Senator STEVENS. If you sit where I sit, my judgment is we have to cut $20 billion.

Dr. COOPER. I understand. That is the effect of the reduction right now. We are requesting a total of 123 test missiles, 108 for test and 15 for surveillance. That is eight a year for the first 3 years and seven a year for the last 12 years.

We expect MX to be in our inventory at least that period of time and possibly longer. You have to buy the test assets while the production line is up and running. We do not think it is a fat test program in any respect.

In fact, I think it is the leanest test program of all the missile programs in the Department.

HISTORY ON MISSILE TEST PROGRAM

Senator STEVENS. I said I agree with Secretary Paisley about things in the record, but I would like to have you give us a statement in the record on the history of the test program vis-a-vis the missiles.

Dr. COOPER. We will be pleased to do that.

[The information follows:]

MX TEST PROGRAM

The Peacekeeper Missile Program calls for 123 test missiles—108 for operational test and evaluation [OT&E] flight testing and 15 for the Aging and Surveillance Program. The OT&E Program has two parts—phase I initially assesses the system reliability (24 missiles launched over 3 years). Phase II is designed to detect, with 90-percent confidence, a 10-percent degradation in system reliability in any 3-year period during the remaining 12 years of the 15-year design service life (seven launches per year).

The program is sized because ICBM experience indicates the potential exists for a 10-percent degradation over a 3-year period. The current program does not have the potential for flight tests of major system modifications. Nor can it verify system performance after the 15-year service life has expired. MM III was designed for a 15-year service life but has been operational for 25 years.

The Peacekeeper Program is austere, especially when compared to other similar missile programs.

Quantity for operational test and evaluation

Peacekeeper	108
MM I	210
MM II	171
MM III	248

Test launches are to missiles as flying hours are to aircraft. U.S. war plans are based on the confidence determined bythe test program. The same number of test missiles are required whether 50 or 100 Peacekeepers are deployed. The Peacekeeper test program is already modest and more austere than anyother comparable system. Any cut will reduce confidence in U.S. war fighting capability.

BASING OPTION

Senator STEVENS. Where are we now in terms of the basing option report we requested concerning the second deployment concept?

That was a prerequisite to considering any further production of missiles for deployment. I have some assessment of the follow-on basing options that range from a low of $4.9 billion to a high of $20-plus billion for the next 50 MX's.

Dr. COOPER. We are currently looking at eight alternatives. They range from super hard silos to carry hard, to shallow tunnel, to a couple of options on Minuteman, to rail mobile. Those will all be brought together in the December timeframe of this year.

That is our current plan where we plan to make a decision. We have $369 million in the budget in 1987 to preserve an option to go forward with R&D on one of those eight during 1987, Senator Stevens. We do not know right now which one it is.

Quite frankly, that is a funding wedge. That is the minimum that we need for any one of those eight. So, that is the status. I do not have a report today other than that we are currently investigating all eight of those options.

RESTRUCTURING OF ASAT

Senator STEVENS. You say ASAT has been restructured, we have a new effort underway. I am told that a $500 million program and the operational aspects of this restructured program are classified, but there is an indication that the buy would be significantly reduced as well as deployment.

Now, your request, I understand, is for R&D this year in ASAT; is that correct?

Dr. COOPER. Let me ask General Randolph to respond.

General RANDOLPH. Yes, sir; the request is for $278 million in RDT&E and $30 million in advanced procurement money. There is no money to fully fund production missiles.

Senator STEVENS. Senator Kasten.

Senator KASTEN. Mr. Chairman, thank you.

MX MISSILE PURCHASE

I also have some questions on the 173 MX missiles and the purchase plans. It is my understanding those three-quarters are being used for the test program.

As I understand the options, what CBO is saying is that you could save up to $8 billion by buying fewer MX test missiles, but by doing so, evidently there is a risk.

I further understand one of the options is that they are saying you can meet your reliability guidelines by having either the same test or modified test every other year rather than every year.

Dr. COOPER. I violently disagree with that.

Senator KASTEN. Will you explain to me why three-quarters of the missiles will be for test purposes and why that savings of $8 billion is not possible?

Dr. COOPER. I draw your attention to the recent events that have occurred with the Titan, Delta, and shuttle to underscore the need to maintain a very vigorous and active test program in any of our missile programs.

Things happen with time in terms of aging. We need to surveil those missiles. If we want to have a force that is up and ready to go, we need to know the status of that force at any one time. The only way we know how to do that is to test those missiles under realistic conditions.

Also, before you came in, I made the analogy that the test missiles to our ICBM program and SLBM program are like flying hours on our aircraft program.

The point I would make to you is that I fully expect MX is going to be in our inventory for more than 15 years.

The other point is that we need to buy the test missiles now while we have a hot production line. If you cut that back and 4 or 5 years from now you determine you need more test missiles, you do not have a way to get more test missiles.

D-5 PROGRAM

Senator KASTEN. Are you using about the same reliability guidelines or are you increasing or decreasing the tests as opposed to the D-5?

Have you changed your basic guidelines significantly or are you basically doing it as you have been doing it for the MX?

Dr. COOPER. We are doing it as we have been doing it for the ICBM program, based on the experience we had with Minuteman and taking into account the improvements we are making in the MX program.

Again, I would point out relative to MX, it is the most austere program of any of the big missile test programs that we have had. I will be happy to supply those figures for the record.

Senator KASTEN. I think all of us ran into some of the same articles. When someone says you can save $8 billion, I just think we ought at least take a look at it. If you have a good reason why we ought not do it, we will listen.

Dr. COOPER. I appreciate that. Let me comment once more—it is an important point to make—I think we get complacent in this business and we start to take ICBM's and SLBM's and space shuttles and these things for granted. Every so often it is brought home to you what a serious business it is and it is not risk-free.

R&M and safety and quality are extremely important factors. The only way we have to monitor those is through an aggressive test program. It is true in MX and also true in the D-5 program.

MIDGETMAN WEIGHT

Senator KASTEN. I have one other question that I want to submit to you for the record and try, if I can, to get the right weight for the Midgetman missile straight.

As I understand it, we have heard the Air Force say 40,000 pounds would be the right weight for the missile. Somewhere else we have 30,500 pounds. It is now my understanding that the right weight for the missile is 37,000 pounds.

Unless you want to reply very briefly here, I have a couple of questions trying to picture where we are going and what your basic plan is.

Dr. COOPER. If we take you back to 1984 when the Price amendment was passed, we were less isolated at 30,000 pounds. The argument we have made, I personally made at the time, is please do not legislate a weight on this missile.

I think what you should legislate is tell us you want single-warhead small ICBM's that will be mobile, give us an opportunity to get into the development program and then we will come back and tell you what the proper weight is.

At that point in time when the legislation was being proposed, we thought 38 to 39,000 pounds was about the right weight. But the Scowcroft Commission had said about 15 tons. Two times 15 is 30,000.

It got put into law. With about 2½ years of experience now under our belt, we think the right weight for the single-warhead small ICBM is around 37,000 pounds. As you go above that, you actually start to degrade and you do not get much additional payload capability. You just add structure to the missile.

Based on 2½ years' experience, the knowledge we now have, we tell you we think we can maintain mobility, we can give you increased throw weight or give you additional range at 37,000 pounds.

We can build a 30,000-pound missile, but it is not the optimum single-warhead small ICBM. If we do continue with the single-warhead small ICBM, we would urge you to let us go to 37,000 pounds. That is the optimum weight.

Senator KASTEN. There are a lot of things we ought not legislate. I think the top of that line would be a specific weight of a specific missile to be made 3 or 4 years in the future.

Dr. COOPER. Sir, I am in agreement with you.

Senator KASTEN. At the same time I am confused because I had noted you agreed or disagreed and there have been bits of changes coming from the Air Force that had nothing to do with the legislation that was passed, as I understand it.

It might be partially the initial statement that was made in the committee report or even in law. But in the press and statements coming from the Air Force there has been a lot of jumping around.

Dr. COOPER. Our position has always been around 37,000 to 38,000 pounds.

I have to tell you when the Scowcroft Commission came forth with its recommendation on the single-warhead small ICBM, there were people in the Congress that were suspect of the Air Force. It was not our idea.

What they did is they wanted to nail our foot to the ground on 30,000 pounds so we did not balloon this thing up and make it a MIRV.

They also wanted to tie its deployment with MX deployment. I can assure you that got our attention. I do not know how we could have moved out more smartly on that.

We have a program office with 200 people. We put a general in charge of that. Now people are saying, if anything, we are moving too fast on it. I think we have the right balance.

CONGRESSIONAL OPPOSITION TO CURRENT SYSTEMS

Senator KASTEN. You are talking to one of those Senators. We are trying two different things.

No. 1 is to be sure you are serious about this program.

We are also trying to deal with the problem that I think we have had in the Congress for a number of years and that is a group of Congressmen and Senators who are always opposed to the system that you can build right now because the one that is going to come in 7 or 8 years is better.

So, you oppose the B–1 because Stealth is coming, you oppose the MX because of Minuteman.

One of the ways we deal with that whole set of questions and problems is to be sure when we make a commitment to go to that next system as part of a compromise we reached in order to build the MX system that we can build right now, that we follow through on that overall effort.

We are not interested in micromanaging the weight of a particular weapon system. What we are concerned about is the opportunity to keep the program together.

My time has expired. Thank you, Mr. Chairman.

Senator STEVENS. Now, we intend to close at noon, gentlemen.

Senator Chiles has asked only one question. Do you have any more questions?

Senator CHILES. I do not, Mr. Chairman.

Senator STEVENS. Senator Johnston.

Senator JOHNSTON. Dr. Cooper, in connection with SDI and ADI, I understand you to say they are not connected in terms of submitting a budget.

I did understand you to say ADI without SDI does not make a lot of sense?

Dr. COOPER. No, I did not say that. We have had ADI without SDI. We always will want to maintain some——

Senator JOHNSTON. ADI in the sense of a robust system?

Dr. COOPER. That is leak-proof.

Senator JOHNSTON. Relatively leak-proof that deals with cruise missiles, et cetera?

Dr. COOPER. I was responding to your quote, I think, from Secretary Schlesinger that said $0.5 trillion. I do not think we want to go to that type of ADI without SDI.

We will want to maintain an air defense capability regardless of what happens to SDI. It is just a matter of degree.

Senator JOHNSTON. I think you mentioned a couple of decades ago you made a decision not to go to the robust ADI because it did not make any sense when you are not even trying to defend against ICBM, thousands of them?

Dr. COOPER. We had a robust ADI relative to that point in time. We let that atrophy with time to some degree.

MITZER TEST ON COST EFFECTIVENESS

Senator JOHNSTON. I understand the so-called Mitzer test of cost effectiveness at the margin, there has been some suggestion that that test has been done away with with respect to SDI. Is that correct?

Dr. COOPER. I do not know what a Mitzer test is.

Senator JOHNSTON. He suggested you should not build SDI unless you can show that to defend against one missile is less expensive that to build that missile, or, to put it conversely, that it should not be cheaper for the Russians to build another missile than it is for us to defend against the first missile.

There has been suggestions in some of the literature that that test is not longer—I think the Secretary of Defense said something to the effect, well, if we can afford it, maybe they cannot, maybe we ought to spend more to defend than they do on building missiles.

Do I read that correctly?

Dr. COOPER. I understand your proposition. I just have not thought that through. I think it is more than just for a one-to-one exchange.

If you could deploy SDI, that would protect the country, then you might be willing to spend more on those factors than the other guy would spend on offensive systems.

Senator STEVENS. A bullet-proof vest costs more than one bullet.

Dr. COOPER. That is a good way to put it.

V-22 OSPREY

Senator JOHNSTON. Would you care to comment on the V-22 Osprey?

Mr. PAISLEY. What is it you would like to know?

Senator JOHNSTON. I happen to think it is a good system. According to the Post today, they said it is a bad system because somebody made a report on it that it would be less expensive to go ahead and build helicopters.

Mr. PAISLEY. There are a lot of naysayers around in any program. The V-22 is a program that was started in this administration, it is going to fly in this administration. It is a program that we moved into and has been supported not only by the Marine Corps, but by the blue suit Navy, itself.

The Air Force supports it and the Army supports it. We will probably have more aircraft in the end than we are talking about now. It is probably one of the best programs, if not the best program I have been involved in while I have been in the Government.

It is the way to do a program. It really is. Two contractors competing all the way, doing the development together, sharing purchase of the tooling, going into a program where we get not to exceed prices. We know where we will be in this program. It is one of the best programs I have been involved in.

Senator JOHNSTON. I am glad to hear that.

Senator STEVENS. It is the way of the future because I predict we will have a ring of airports around a city like Washington where those, when they get into civilian application, will be providing the kind of intercity transportation that we need to return to in order to improve the efficiency of our short distances at reduced cost.

Senator JOHNSTON. I understand you can fly from the Capital to the Trade Building in New York in 35 minutes.

Mr. PAISLEY. You can fly from a heliport by my house and walk into the Trade Building in New York in 25 minutes. I gave a briefing on Monday to the civilian sector and to the Port Authority of New York and New Jersey.

I have been involved in the passing program because I worked at Boeing where there is a commercial program. I have never seen a program that the commercial sector is getting so excited about—and particularly by individuals operating Port Authorities.

They are now starting to worry about what they are going to do with this airplane—and this is the earliest point at which I have ever seen anybody worrying about any airplane.

Senator STEVENS. It will cut down the dollars that go into asphalt and into waiting rooms and put people on planes and fly them out faster than anyone can dream of. I think it is the second revolution we have seen in terms of aircraft.

The first one was when we got the rotary blade. Now we are going to combine the two. That is the second revolution in the aircraft industry.

Senator JOHNSTON. So there, Washington Post.

SUBMITTED QUESTIONS

Senator STEVENS. Thank you, gentlemen, very much. I did get into some of the things—I hate to submit things for the record—there are some questions of General Randolph about bomber structure.

I do want to talk more about the Cheyenne. We will make them short. I would like to ask those questions. I am talking about money, not philosophy.

[The following questions were not asked at the hearing, but were submitted to the Department for response subsequent to the hearing:]

QUESTIONS SUBMITTED BY SENATOR D'AMATO

CONVENTIONAL USE OF THE ATB

QUESTION: As ATBs are developed, will B-1B's shift to a more conventional role? Does the Air Force plan to avoid conventional use for the ATB?

ANSWER: The Air Force plans to dedicate (d) non-ALCM B-52Gs to conventional taskings beginning in (d). The B-1B is capable of both nuclear and conventional missions. A portion of the B-1B force will be dual-roled as conventional capabilities are developed and deployed. Details regarding the military capabilities of the ATB are controlled under special access procedures. Procedures have been developed to provide this information through the committee staff.

D-5 MISSILE

Question: The Submarine-Launched D-5 Ballistic Missile will be highly accurate. One of the reasons for increased concern over the survivability of our Land-Based ICBMs is that our submarine Launched Ballistic Missiles were not accurate enough to be a credible deterrent, except against large civilian targets. How will the introduction of this missile improve our ability to deter a Soviet Attack?

Answer: The D-5 missile possesses a significantly improved ability to hold at risk hardened Soviet targets when compared to the C-4. D-5 thus contributes to the vitality of deterrence. One aspect of this contribution is the fact that the overall U.S. strategic forces, when the D-5 missile is included, will be better able to hold at risk both hard and soft targets than a comparable force equipped with only the C-4 missile. Futhermore, the deployment of the D-5 is necessary to completely fulfill our policy of deterrence -- being able to hold the full spectrum of Soviet targets, including the hardened facilities which the Soviets prize most, at risk with the most survivable component of our strategic forces. Such a deployment of credible hard target capability in a survivable basing mode reduces Soviet incentive to initiate aggression, particularly a nuclear attack against the U.S. and its Allies. Deployment of the D-5 missile is thus both necessary and consistent with the requirement for sea-based strategic forces to provide a survivable and enduring contribution to the ability of U.S. strategic forces to deter the Soviets.

QUESTIONS SUBMITTED BY SENATOR STENNIS

B-1B Contract Overruns

QUESTION: The latest DoD Selected Acquisition Report (SAR) on the B-1B, released in March, indicates that the B-1B Program Manager expects contract overruns of nearly $1.7 billion. The SAR states that the "Program Manager projects a cost overrun" on three contracts and that the program impact is "insufficient contract reserves."

($ in Millions)

Contract	Current Contract Target Price	Current Program Manager Estimate	Projected Contract Overrun
Airframe (Rockwell)	13,682.0	14,875.0	1,193.0
Avionics (Boeing)	1,951.7	2,092.4	140.7
Avionics (Eaton)	2,442.8	2,764.4	321.6
TOTAL	18,076.5	19,731.8	1,655.3

Previous information indicated that the B-1B was running under cost. What is the reason for the cost overruns projected by the Program Manager?

ANSWER: We do not have nor do we project a cost overrun for the B-1B program. The column labeled "Projected Contract Overrun" would be better labeled "Overtarget Estimate." The figures in this column represent estimated contract cost outcomes which are well within the $20.5B (FY 81$) certified cost cap and within contract ceilings. A potential for overtarget performance was anticipated in the $20.5B program which budgeted to a "most probable cost." However, since the B-1B program funding has been reduced to less than $19.6 billion (FY 81 $), there is some potential for exceeding available funding without exceeding the certified $20.5 billion cost cap.

In September 1985, following award of three major B-1B multiyear procurement contracts, the Air Force provided Congress with a "Full Accounting" of B-1B costs. The Air Force described program funding (FY 86 budget) as consistent with its estimates of most probable cost (vice target cost), and said it was premature and risky to reduce that funding. Nevertheless, Congress reduced program procurement funding by almost $1.2 billion (TY $).

The Air Force is working hard to bring the program in at the reduced level of funding; however, our estimates of most probable cost continue to indicate that supplemental funding may be required in the future. We should be able to confirm the exact magnitude of any shortfall early next year. Even if supplemental funding is required, we remain confident that the program will not exceed the $20.5 billion (FY 81$) certified cost cap.

AIR-LAUNCHED ANTISATELLITE SYSTEM (ASAT)

QUESTION: The latest Selected Acquisition Report (SAR) on ASAT, issued in March 1986, indicates that the Program Manager is projecting overruns on three contracts totaling almost $298 million, or 46 percent above target cost.

($ in millions)

Contract	Contract Target Price	Current Program Manager Cost Estimate	Projected Cost Overrun
Minature Vehicle (MV) & Upper Stage (RDT&E)	338.1	606.4	268.3
F-15 Lower Stage and Mission Control	256.2	274.9	18.7
Instrumented Test Vehicle (ITV)	51.4	62.0	10.7
TOTAL	645.7	943.3	297.6

What is the cause of this cost overrun?

What share of the cost overrun is due to causes other than Congressional testing restrictions, such as schedule slips?

ANSWER: The difference between the Contract Target Price and Current Program Manager's Estimate to Complete does not necessarily represent an overrun. Each contract must be specifically analyzed by type, terms, and conditions, to determine whether the difference is caused by additional authorized work or cost overruns. The following is a detailed summary of the differences for each contract:

1. MV and Upper Stage. The major reason for the difference is due to a cost overrun and is associated with technical problems experienced early in the program. In our Dec 1984 SAR, we projected a $227.9 million difference, of which $196.7 million was overrun. The present $268.3 million difference can be broken out as follows:

$219.8 M	Cost overrun
21.0 M	Congressional testing restriction
28.5 M	Award fee and new authorized work

2. F-15 Lower Stage and Mission Control. The $18.7 million difference is not a cost overrun but is caused by the addition of a technical change order which extends the schedule due to the Congressional testing restriction.

3. ITV. The $10.7 million difference is not a cost overrun. $5.2 million is due to the Congressional testing restriction and $0.3 million is for a launch support option. The remaining $5.2 million funds this Fixed Price Incentive Contract to its ceiling price.

The projected cost overruns are summarized below:

Contract	Contract Target Price	Projected Cost Overrun	% Cost Overrun
MV & Upper Stage	338.1	219.8	65
F-15 Lower Stage and Mission Control	256.2	0	0
ITV	51.4	0	0
TOTAL	645.7	219.8	34

B-1B LONG-LEAD FUNDING

QUESTION: There is a proposal to add $200 million to the 1987 budget to procure long-lead materials for possible procurement of additional B-1B bombers beyond the 100 aircraft already funded by Congress.

The added funds would be used to keep the B-1B production line warm and ensure that the production line gap between the end of the current 100 aircraft program and a possible future program would not widen.

What is your reaction to this program?

ANSWER: The Air Force is strongly opposed to this proposal. The Two Bomber Program charted by the President in 1981 was carefully structured to minimize the risks inherent in the stealth technology area. Our investment in a comprehensive risk reduction effort makes us highly confident that the Advanced Technology Bomber will meet its performance and cost ojectives. Based on that assessment, there is absolutely no need to add unnecessary funds "to keep the B-1B production line warm."

MULTIPLE BUY OF DSP SATELLITES

QUESTION: The 1987 budget proposes a multiple-year contract for procurement of five new satellites.

What is the added cost in the 1987 budget, if Congress approves multiple-year contract authority?

ANSWER: According to the multiple-year contract exhibits submitted with the President's Budget, an additional $116 million is required in FY 1987 when compared to an annual buy with the same buy profile as the proposed multiple-year. However, this annual buy will not deliver the satellites in time to meet the required launch dates.

The increased efficiencies associated with a multiple-year contract will provide a faster delivery schedule, which will meet the launch schedule. When the multiple-year contract is compared to an annual buy profile that will also support the launch schedule, the added cost in FY 1987 is $50 million.

A comparison of these options can be seen in the attached table:

PROCUREMENT OPTIONS FOR DSP SATELLITES 18-22

	FY 87	FY 88	FY 89	FY 90	FY 91	TOTAL
MULTIYEAR	long lead	1	2	1	1	5
(meets launch requirements)	$250M	$349M	$386M	$189M	$150M	$1,324M
ANNUAL BUY	long lead	1	2	1	1	5
(does not meet launch requirements)	$134M	$438M	$515M	$351M	$215M	$1,653M
ANNUAL BUY	long lead	2	2	1		5
(meets launch requirements)	$200M	$616M	$526M	$234M	-	$1,576M

TOTAL COST SAVINGS

QUESTION: What are the total cost savings that accrue from using a multiple-year contract for these five DSP satellites?

ANSWER: The total cost savings from using the multiple-year contract is $329 million and these savings begin to accrue in FY 1988.

CONTRACT CANCELLATION

QUESTION: What is the likelihood that, at some time in the future, the Air Force might want to cancel this contract because of affordability or a technical breakthrough that would make the DSP satellites obsolete?

ANSWER: The likelihood that this contract will be canceled because of affordability, obsolescence or any other reason is extremely low.

DSP is the Air Force's highest priority satellite system, [deleted]. These satellites are required, and a multiple-year contract allows us to buy them at the lowest price.

It is highly unlikely that a technical breakthrough could be developed into a replacement system by the 1990's, the operational period for these satellites.\ [Deleted.]

SUBCOMMITTEE RECESS

Senator STEVENS. The subcommittee will recess subject to the call of the Chair.]

[Whereupon, at 12 noon, the subcommittee adjourned, subject to the call of the Chair.]

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1987

FRIDAY, MAY 9, 1986

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 10 a.m., in room SD-192, Dirksen Senate Office Building, Hon. Ted Stevens (chairman) presiding.

Present: Senators Stevens, Cochran, and Proxmire.

NONDEPARTMENTAL WITNESSES

DR. EDWARD TELLER

STATEMENT OF DR. EDWARD TELLER, SENIOR RESEARCH FELLOW, STANFORD UNIVERSITY'S HOOVER INSTITUTION; ASSOCIATE DIRECTOR EMERITUS, LAWRENCE LIVERMORE NATIONAL LABORATORY; AND MEMBER, WHITE HOUSE SCIENCE COUNCIL

STRATEGIC DEFENSE INITIATIVE

OPENING STATEMENT OF SENATOR STEVENS

Senator STEVENS. Good morning.

This is the fourth hearing we will hold this year on the subject of the Strategic Defense Initiative. Thus far, the subcommittee has held two hearings with Lieutenant General Abrahamson, Director of the Strategic Defense Initiative Organization, and also an outside witnesses hearing with former Defense Secretaries Harold Brown and Robert McNamara.

We also held a special classified briefing on Soviet strategic defense activities. The subcommittee's review of the fiscal year 1987 budget request for SDI has been as extensive as that of any other committee in Congress.

With us today to present expert testimony on SDI is the world-renowned physicist, Dr. Edward Teller. Dr. Teller is a senior research fellow at Stanford University's Hoover Institution. He is Associate Director Emeritus of the Lawrence Livermore National Laboratory, and serves on the White House Science Council.

I believe Dr. Teller is uniquely qualified to testify before this committee on the SDI Program. In 1941, at a time of great need and peril to our country, he was recruited as one of a number of scientists to work on the Manhattan project, the program to develop an atomic explosive weapon through nuclear fission.

In the late 1940's, Dr. Teller was also the principal force behind development and testing of the hydrogen bomb. Dr. Teller was instrumental in the founding of the Lawrence Livermore National Laboratory after World War II. Few witnesses could have better, firsthand knowledge of nuclear weapons development and management of large-scale research and development programs than Dr. Teller.

After hearing from Dr. Teller we will receive testimony from Dr. Martin Hoffert representing the Science and Engineering Committee for a Secure World.

We welcome you, gentlemen.

Dr. Teller, you are first. We will be happy to have your testimony.

We will print your statements to be presented here this morning in full in the record. We would ask that you proceed in any way you wish.

Senator Proxmire, do you have an opening statement?

Senator PROXMIRE. No, Mr. Chairman.

Senator STEVENS. Thank you very much.

STATEMENT OF DR. TELLER

Dr. TELLER. Thank you very much, Mr. Chairman.

Indeed, while I had started as an enthusiastic worker in pure science, even before the Second World War started, at the time fission was discovered, it became clear to some of us that the world would change in a drastic way and we had a responsibility that this change should not occur without proper information and understanding.

There is one thing that I have done consistently from then up to this day, and I hope for a short time in the future. That is to make sure that work, decisions, behavior should not be based on ignorance. We must not close our eyes to the possibility of the atomic bomb, the hydrogen bomb, computers, space travel. We should know particularly about defense, not only against rockets, but defense in general.

FUNDING FOR SDI PROJECT

There is a very great difference between the present situation and the situation at the time of the Manhattan project. There I participated in practically every phase at every time of the project.

One difference is in funding. Chairman Stevens has drawn the comparison very aptly that the Manhattan project was funded at a high level, at a level comparable to funding for landing a man on the Moon. But the present proposed funding on SDI is on a lower level.

At the same time, there is also a considerable difference when we remember the technical support at the time of the Manhattan project. Practically everyone was available. Today many are available in industry. We have some support in academia, but we also have a debate going on and the debate is always welcome.

Perhaps it detracts too much time and effort from real work and it makes it a little difficult to attract young talent. Whatever is said against

SDI is widely reproduced by the press and does not fail to impress the young scientists. I want to give one remarkable example of this situation.

X-RAY LASER

An old-time friend, Dr. Hans Bethe, visited our laboratory and inquired about one specific subject, the x-ray laser. That is a remarkable new initiative, the only true initiative in SDI. As such, it may turn out not to be practical or may turn out to be more valuable than all the other efforts put together. In this state of development that is in the research phase, the x-ray laser must have high priority.

Bethe was greatly impressed by the progress made. He recommended that we stop it. If we continue, the Soviets will imitate us. Actually, the basic ideas for the x ray laser came from the Soviet open literature, approximately 8 years ago. Then they became silent on the subject. We have indirect evidence that the Soviets performed x-ray laser experiments much more plentifully than we did. We are imitating them. Han Bethe imagines that they may be imitating us. The same holds in many other fields; for instance, high-intensity lasers. This is a difference between the Manhattan district and the present day.

At that time we were real pioneers. Today there are many indications that in relevant areas—with the exception of computers—we are running second. Because of this situation, we have taken the reasonable step of turning to our friends and allies for help.

ALLIED SUPPORT

We have cooperation now with the British, the Germans, and recently with Israel. This includes short-range rocket defense, a very relevant subject that could bear practical results at an early time. We have taken the step of telling those who cooperate with us that we will accommodate the way in which they want to cooperate.

In this regard, we are more open than we have been ever before. Through this cooperation we get badly needed new ideas in a new field. We get constructive criticism. I believe that further expanding this cooperation—the Italians and the Japanese are good candidates—is a truly excellent idea.

The President indicated that in the long run we even wish to share with the Soviets in the interest of the safety of everybody. The Soviets today are not interested. Of course, they are not. They are ahead of us. Possibly they know all our secrets including those that we shall discover 2 years, even 5 years from now.

BUDGET REQUEST

The specific point is the budget request. I have endeavored to look into that as a member of a technical advisory committee to SDI.

There is a whole new class of weapons, the directed energy weapons where there is tremendous progress. I am now not talking about the most interesting x-ray laser. I am emphasizing lasers that emit extremely high intensity light.

HIGH-INTENSITY LASER WORK

We have known for 10 years, for 15 years, that this high-intensity work is being pursued by the Soviets. I was aware of it long ago. I have to confess that I did not realize its significance. We now notice that these are very effective ways of defense. The intensity of light is so high that it has difficulty penetrating the atmosphere.

There are some peculiar effects there that the Soviets had investigated 10 years ago, we only a couple of years ago. Efforts in that direction, I believe, are highly important.

SATKA

Another area that receives a great deal of emphasis is what is called SATKA, including the early discovery of a rocket-launched. This is vital to all the other parts of the program and, therefore, needs to be emphasized. Without it, the rest of the program will suffer. It will not fail completely because Over-the-Horizon [OTH], for instance, can serve instead.

SPACE OBSERVATION

Space observation remains the best method and it is highly supportive of anything else. In general, we must do the whole program in a cost-effective way, but space observation executed at less cost is a cornerstone.

A third item is the kinetic energy weapon. There has been a most welcome recent change. There is more emphasis on popup systems that need not be predeployed and whose success we can count on.

ROCKET DEVELOPMENT

We know that the Soviets have traditionally, as well as recently, done a lot about developing rockets. They have them in their inventory. They also give them to their client states in the Middle East. Thereby they create very real dangers. This is one of the reasons why Israel, without any political difference between right and left, joined SDI. They are willing workers, emphasizing the short-term goal of defense against short-range weapons.

COMPUTER FIELD

There are other fields that I have to mention. The use of computers is the only field where we are ahead of the Soviets. The applications of these computers to defense are still in a primitive state. The linkage between the computer and the rest of the system, needs careful attention.

There are vocal people who consider the computer program unfeasible. There are many more willing workers who are supporting the computer proposals. I do not think SDI has enough money to support all the hopeful new computer propositions.

Finally, there is a very important, small initiative: How to put a satellite into orbit in a less expensive way. As long as it is more easy to shoot down a predeployed object than to deploy it in the first place, predeployment will be of dubious value.

TRANSATMOSPHERIC VEHICLE

There are new prospects: One of them the President talked of as the Orient Express. It is technically known as the transatmospheric vehicle.

Some of the sponsors of this program advocate manned development. They want a man in control, even during the tests. SDI is the one sponsor of the Transatmospheric Vehicles Unmanned Program which does not need men in space. An unmanned program is the least expensive. It is feasible at an earlier time.

If I have a clearcut criticism, this one is the first. To put unmanned objects into space does not receive as much emphasis as it should. Such methods should be developed even before a detailed discussion of properties of weapons that go into space.

I would like to say the obvious. We are involved in research. Research is no good unless something new is discovered. Therefore, if this year's program is different from last year's program, if next year's program will be different from this year's program, this means that we have intelligent and flexible leadership.

I have had ample opportunity to compare General Groves, leader of the Manhattan project, with the present leader, General Abrahamson. I see excellent performance in the present program under exceptionally difficult circumstances.

SECRECY

I would like to add one topic. As in all of our other military enterprises, we have a problem of secrecy. Secrecy restricts information to a very few people who are very busy. In some cases, the result is insufficient internal review. To that has to be added that in an atmosphere of secrecy misinformation can get around and disinformation can flourish.

The Soviets know our secrets; the American people do not. A change toward more openness, I believe, would be most welcome.

I want to conclude by one simple appeal. The President has asked for less than 2 percent of the defense program to support the one field where the Soviets are ahead of us. Their advantage may well result in the foreseeable future in a situation where our retaliatory forces will become obsolete. Under these circumstances, not to be fully informed what the potentials of defense are is inexcusable negligence.

When Chamberlain went to Munich, the Second World War became inevitable. I was then a young man and that situation persuaded me to change. I did change from pure science, which was my favorite topic, into practical applications. This became a duty.

Gentlemen, your action in approving the President's SDI budget is the best way to save the world from a third World War.

Thank you very much.

[The statement of Dr. Teller follows:]

PREPARED STATEMENT OF DR. EDWARD TELLER

Summary

Shortly after the discovery of fission, forty-seven years ago, it became clear to me that development of weapons of mass destruction based on nuclear energy had become inevitable. From that time on it became increasingly clear to me that in a new and more dangerous age scientists had to play their role in making it clear to free people what their dangers are and in what way these dangers may be avoided or diminished. My dedication to this effort took final shape when I heard President Roosevelt's response to Hitler's invasion of the lowlands in 1940. He challenged scientists to work on the weapons without which freedom would perish. At that time Roosevelt had been informed of the possibility of atomic explosions.

Forty-three years later President Reagan made a similar appeal which was based, according to my knowledge, on years of careful consideration. He challenged scientists to find methods of defense against weapons of mass destruction.

Following Roosevelt's appeal the atomic bomb was developed in little more than five years by the joint effort in the United States by scientists from several countries. The war effort, both in radar and in nuclear weapons, was so intense that publications on pure science dwindled to a small fraction of what they are in peacetime. While we were working so did Nazi Germany and Soviet Russia. It is not easy to judge which of the two made more progress, but the Soviet Union tested a nuclear explosive in the late summer of 1949, much earlier than had been generally expected. Our own wartime record led to the result that the first atomic bomb did not become available to a dictatorship, but a democracy. In this way the war was ended and American power was used to help recovery both among our competitors and among our former enemies. Had the bomb first been developed by a dictator, his absolute power would have been extended over the world.

After the successful Soviet test of a nuclear explosion some of us argued that our work during the war had been incomplete and that with a moderate amount of additional work a thermonuclear weapon could and should be developed. Many scientists argued at that time that if we did not develop the hydrogen bomb neither would anyone else. It is now clear from the publications of Sakharov[1] that he, the inventor of the Soviet hydrogen bomb, had been drafted to work on that super weapon a year and a half before the thermonuclear debate started in the United States. President Truman made the decision to proceed with work on the hydrogen bomb and fortunately we finished work on that subject a short time before the corresponding Soviet success.

Today we are engaged for a third time in a similar competition with the Soviet Union, but there are two differences. One is that in the two earlier competitions weapons of aggression were developed. On this occasion we are looking on President Reagan's initiative for methods of defense against aggressive instruments of mass destruction. The second difference is that, while on two earlier occasions we started from a technological advantage, in the field of defensive weapons the Soviets have worked diligently for two decades while our own efforts have been meager and hesitant. Indeed, in contrast to our wartime effort, few academic scientists participate in our work.

The Strategic Defense Initiative should be properly called Strategic Defense Response. According to President Reagan's instructions we start with a vigorous research effort which is not in conflict with the letter or spirit of any treaty. A number of dedicated scientists are participating in this effort and we are seeking the collaboration of our allies. Agreements are taking shape with England and Germany. Further collaboration looks hopeful with Israel, Japan, and Italy. Eventually, President Reagan has suggested that the art of defense should be shared with the whole world including the Soviet Union.

The Purpose of SDI

It is a mistake to believe that we are pursuing a plan for an impenetrable shield protecting the United States. Our purpose is to deter war by making the success of aggression less likely, thereby, we can contribute to deterring aggression. While we are in research it is important to maintain the effectiveness of our offensive deterrent. As the research is successful, we can emphasize a defensive deterrence and a more stable basis for peace. Such policy is surely in consonance with the feelings of the American people, and modern developments show that it is technically the sound direction to pursue.

Defense will become practical only if it is effective. Feasibility is not the only criterion. It is also necessary that defense should be less expensive in effort and money than countermeasures. It should also be less expensive than a compensating increase in instruments of aggression. Research on defense performed thus far encourages us that these aims can be attained. Soviet protests are further evidence that they do not consider defense as an unimportant or infeasible activity.

The purely economic criterion cannot be met quantitatively in the face of uncertainties. In case of any doubt we should do what is affordable to enhance the chance for peace.

Early concrete successes could be of great importance, even if the successes are partial. Thus, tactical defense against short range missiles would be important for our allies, could decrease the threat of submarines to the United States, and would serve as a first step toward a more total defense of the United States.

Predeployment in space appears to be difficult because according to the current situation it seems at present more expensive to launch a satellite than to shoot it down. The question, however, needs to be included in the present research phase because the Soviets may well pursue this possibility, because launching of satellites could become less expensive and finally because destruction of satellites could be made more difficult by any of several methods.

The defensive program on which we are embarking is a broad one and it is unreasonable to determine at this time any particular plan of deployment. My experience with research and specifically with research on defense is that new initiatives lead much farther than was originally planned. This was true in atomic explosives, in electronics, in computer development, and in the magnificent space enterprise.

Soviet Defense

The Soviet Union started on the strategic defense of Moscow at least two decades ago. By now they have upgraded their system. Probably two layers of defense are presently available, and such defense can be carried out with the help of appropriate nuclear explosives which will do no damage on the ground and are adapted to destroying incoming missiles. This "terminal defense" is made more easy because light and cheap decoys are slowed down and burned up as they reenter the atmosphere.

The Soviets have ample opportunity to train their people in terminal defense. They also may have prepared components for a dozen or more sites that they plan to defend. Such defenses could be put in place in the Soviet Union in less than a year.

The one particularly expensive and time-consuming element in this type of strategic defense is the big radar system. Such radars have been limited in the ABM Treaty of 1972; the Soviet Union has disregarded these limitations. The well-known example is the radar at Krasnoyarsk. When this instrument is completed the Soviets will be in the position to use terminal defense in an effective way for the whole of the Soviet Union, with the exception of the easternmost tip of Siberia.

Rockets are most vulnerable in their boost phase while they are accelerated.

The fragility of this stage has been tragically demonstrated in the recent Challenger accident. The Soviet Union has been working on various instruments of defense that could attack rockets in their boost phase or in mid-course. In my opinion, the most important of these are various kinds of lasers. According to estimates published by the Pentagon,[2] the Soviet Union has spent on the appropriate high-intensity lasers at least a billion dollars annually for several years. Our planned laser budget has not reached this level as yet. The Soviets have also deployed an effective prototype at the test site Sary Shagan, located in Siberia on the shore of Lake Balkash. This establishment appears to be far ahead of any American experimental laser facilities.

The x-ray laser is a novel variety of laser whose energy penetrates into the skin of the attacked missile, but which can act only in space or in the uppermost fringes of the atmosphere. As a defensive instrument, it probably will have to be popped up when an enemy launch is noticed. Our own efforts in that field have been stimulated by Soviet publications which stopped abruptly in the late 1970s.

Lasers may be the most effective directed energy weapons which are not weapons of mass destruction but can be used to destroy aggressive weapons at definite locations at great distances. Other weapons of this kind are electron beam weapons and neutral particle beam weapons. These also can be used to discriminate between decoys and rockets. The Soviet Union has lead the way in both these developments.

Still another important development which could be useful both in the terminal phase and in space are rockets guided to their high altitude targets from ground launch points. The Soviet Union has developed several generations of these. Some of them have been used in the 1972 war in the Middle East. The much more modern SA-12 is probably highly useful in missile defense as well as conventional air defense.

A Possible Scenario

I do not believe that the Soviet Union plans to attack us. It is, however, obvious that Russian imperialism and the expansion of Russian influence did not come to an end when the czars were deposed. In the Persian Gulf, in Central America, or elsewhere conflicts may arise and a Soviet nuclear strike could become possible. The best way to diminish this danger or to eliminate it is to make its success improbable. Predictions cannot be made reliably, but it is useful to consider a possible scenario.

Assuming that the Soviets plan to launch a nuclear strike, they may establish instruments to prevent our retaliation and deploy them in Cuba and on ships or submarines in the Atlantic and Pacific. The Soviets would expect our retaliation and with simple instruments from satellites or ground-based radar they could observe the launching of our retaliatory missiles. Upon such an American launch, Russian instruments could be popped-up. These could be mirrors to reflect and direct high intensity laser light or they could be x-ray lasers driven by nuclear explosives. The latter are novel developments and at the present time we cannot judge whether they will be relatively unimportant or exceedingly useful.

When both our retaliatory rockets and the Soviet instruments have reached a 50 or 100 miles altitude, the Russian instruments will be in a line-of-sight with our retaliatory missiles. Our missiles will be still accelerating and, therefore, highly vulnerable. Most of them could be destroyed in the boost phase.

The Soviets have a triple chance to render our retaliation harmless: preventive strike on our missiles, destruction of our missiles in the boost phase as described above, and terminal defense as discussed in the previous section. Under these conditions, the Soviets may be tempted to attack. The primary purpose of SDI is to discourage attack. Its secondary purpose is to limit the effects of attack if it should occur nevertheless.

The American Advantage

The United States has one potential advantage over the Soviet Union. Our computers are far better developed than theirs. This gives us a great potential advantage in battle management.

However, as long as we have no defensive instruments to manage and as long as we do not perfect the appropriate computers to serve in the battle management, this advantage will not be realized.

Battle management in a full-scale nuclear war will be obviously difficult. This is particularly true if we are caught by surprise and, since the United States will not execute a first strike, we must be prepared to absorb a massive and elaborate attack. Therefore, it will not be easy to realize the full advantage that our advanced computer technology can give us.

The Needed Budget

The President has asked for a little less than 2% of our military budget to spend on SDI research in fiscal 1987. This is certainly not as much money as the Soviets will spend on the same general purpose in the same period. Considering the fact that in true defensive measures we are late comers, this requested amount is desperately needed.

Our efforts on SDI are of recent origin and one cannot expect that in spending money in this direction no mistakes will be committed. It is, of course, necessary that Congress review both spending and progress. It seems to me very difficult to earmark funds for special expenditures. Directing research by those who do not participate in it in a direct manner has always proved to be difficult and in the long run unrewarding. At the same time, constructive criticism and advise are of high value.

The SDI efforts proceed under exceptionally difficult circumstances. The present leader of the project, Lt. General James Abrahamson, is eminently suited for this task both in his technical knowledge and in his organizational efforts. His performance is without parallel in my four-and-one-half decades of experience in such matters.

Obsolescence of Aggression

Our government has taken the initiative to collaborate on defense with our friends and allies. The President has stated that the end results should be shared even with the Soviet Union.

The purpose of rendering weapons of mass destruction "impotent and obsolete" can be accomplished by international cooperation which is directed in general against aggression and at the moment more specifically against the launching of aggressive rockets, particularly when great numbers of rockets are launched at the same time. We are beginning to succeed in finding methods of defense against such instruments.

Our flexibility in seeking cooperation from other nations in any form in which we can obtain it is both unprecedented and encouraging.

One should not expect that aggression will become impotent and obsolete overnight, but as we demonstrate step-by-step that defense can be made less expensive and more effective than aggression, everyone will be convinced in his own interest that defense is preferable. In this gradual way the threat of aggression, the most dreadful concomitant of technological development, can indeed by lifted from mankind.

At this time the Soviet Union enjoys a monopoly in defensive weapons and also in most of the research leading to such weapons. They do not intend to lose this monopoly; hence, their opposition to SDI and their lack of interest in sharing information.

As we make progress toward realistic and effective methods of defense and as we gain participation of more and more nations in this effort, the interest of the Soviet leaders will increase. The Soviets have already returned to the conference table. They proved in the past to be flexible and also open to accept reasonable peaceful compromises where such can be had without danger to themselves.

Due to the open discussion generated by the democratic process at home and abroad, it is becoming perfectly clear that the purpose of SDI is not to isolate America, not to obtain superiority over the Soviet Union, but to preserve peace for ourselves and for everybody else. This was the announced purpose of our President on the 23rd of March 1983. It should be a non-partisan issue.

During the Second World War I participated in pratically all phases of the Manhattan Project which was an effort to avert the most terrible consequences to which this war might have led. The challenge today is to avert a third world war. I believe this deserves the full support of Congress. The large majority of the American people have already demonstrated their support.

References:

1. Sakharov, Andrei D., Sakharov Speaks (Knopf, New York, 1974), p 30.

2. Soviet Strategic Defense Programs, released by the Department of Defense and Department of State, October 1985.

BUDGET FOR SDI

Senator STEVENS. Thank you, Dr. Teller.

You make a good point about the percentage of this budget that would be dedicated to SDI. One of the trends that I perceive from the hearings we have held this year and meetings we have had is that there does not seem to be total opposition to the SDI research funding, but there is a growing feeling for the requests on making this research proceed at a pace where the spending is inefficient.

With your background on the Manhattan project and your experience with regard to the space programs, do you see inefficiency in the application and the use of the funding that we have made available so far in SDI?

Dr. TELLER. Yes; I do. I believe that the President's budget may be criticized because it is too little.

Senator STEVENS. Too little?

Dr. TELLER. Yes; let me give you an explicit example.

X-RAY TESTING

Some of the vital experiments depend on conversion of nuclear energy into x rays. The Soviets have carried out a great number of experiments, tests that are directed or seem to be directed—we do not know, of course—toward that end. The ideal way to do that is in tunnels. That is what the Soviets are doing.

Because we save on money—in this case it is the DOE money, not DOD money—we have to perform our experiments underground in underground holes. If we could work in underground tunnels our progress would be faster. The difference in cost would be $200 million, or maybe $400 million. Our progress is limited by money, not by technology.

There is a more general answer, Mr. Chairman, to your question, and I think, perhaps, more understandable and more relevant. If there is a high spending level, there are many people who are attracted because of the momentum of the enterprise. With the rate of spending going up, the quality of people whom we can attract also will go up. We have available to us young people in this country.

By now the British, Germans, and Israelis are eager to cooperate. The more the spending, the more will be the matching spending, the more will be the intellectual contribution in many parts of the world. I believe we are at a stage where more spending will be more efficient spending.

LINK BETWEEN SDI PROGRAM AND GENEVA NEGOTIATIONS

Senator STEVENS. In your judgment, do you see a linkage between the SDI Program and the negotiations in Geneva, Dr. Teller?

Dr. TELLER. Obviously. Without the SDI project, there would be no negotiations in Geneva. That is why the Soviets came back to the conference table.

Furthermore, the type of discussion that is now being carried out happens to be along the lines of old style arms limitation which were not checked, which did not work for two or three decades. We are trying the same thing over again.

If I may take the liberty, I have been trying to think about that subject, which is a little out of my field, in an active way. I have a proposal.

PROPOSAL ON SPACE MILITARIZATION

The Soviets are complaining about militarizing space. I would like to see a treaty proposed where we say that no satellites must be launched into orbit without it being checked out on the launching pad for containing nuclear components.

This can be done by observation from outside the rocket without taking it apart. If nuclear components are there, it should be required to inspect the rocket to see that the component is a reactor and not an explosive. If a rocket is not inspected, then everybody should have the obvious right to shoot it down as a dangerous object and shoot it down in its boost phase or as soon as possible.

If we made such a proposal, the Soviets would either have to back down from their fighting the proposal of militarizing space, because this way we could effectively eliminate their pretense that we attack from space, or they will have to agree to a treaty which, in turn, could lay the foundation of an international agreement by which mass launching of rockets can be eliminated.

Senator STEVENS. That would be very interesting if the Soviets would agree to the kind of inspection that you suggest, Dr. Teller.

SECRECY IN SDI PROGRAM

I am also interested in your comment about the excessive secrecy in SDI in view of the feeling that we have that the Soviets know a great deal about our program, more than the American people know.

Is the extent of the classification in SDI a deterrent to full participation by university and intellectual communities in this research?

Dr. TELLER. It is psychologically a deterrent. In actual applications SDIO has been generous in extending access to opponents, even to outspoken and unfair opponents. I have personally advocated that information under proper circumstances be given to everybody, no matter what his opinion happens to be.

I, furthermore, am independently criticizing secrecy as ineffective and harmful to rapid and inexpensive progress. I think a lot could be done by technological openness which, in any case, is the announced final aim of President Reagan.

EXPENDITURES ON DEFENSIVE FORCES

Senator STEVENS. The information that we have received here in our subcommittee from the Department of Defense is that the Soviet Union is spending for defensive forces roughly equal to what it spends now for strategic offensive forces, a much different balance than we have.

Do you think that this is a problem for our country with regard to the expenditures for the defensive component of the strategic forces?

Dr. TELLER. I believe it is. I think we must spend more on defensive forces, and if this involved some judicious reconfiguration of our spending on offensive forces, I will not be able to protest.

Senator STEVENS. Thank you very much.

Senator Proxmire.

Senator PROXMIRE. Thank you, Mr. Chairman.

Mr. Chairman, I share your great esteem for Dr. Teller. As you say, he is a world-renowned physicist. He made a magnificent contribution to the development of the Manhattan project, the atomic bomb and later, of course, a leading figure in persuading the President to develop the hydrogen bomb.

COST OF SPACE BASING OF SDI

I also share your strong view on the excessive secrecy and the negative effect of that, also on the vulnerability of our space-based SDI project to the extent that we go space based, and I understand you have some criticism about that.

I also share your very strong view, as I understand it—you have not voiced it so much this morning—but your strong view on the cost of space-based strategic defense initiative hardware.

Now, Dr. Teller, what puzzles me is on page 2 and on pages 7 and 8 you say the same kind of thing. You say on page 2:

> The second difference is that, while on two earlier occasions we started from a technological advantage, in the field of defensive weapons, the Soviets have worked diligently for two decades while our own efforts have been meager and hesitant. Indeed, in contrast to our wartime effort, few academic scientists participate in our work.

Then you say on page 7:

> This is certainly not as much money as the Soviets will spend on the same general purpose in the same period. Considering the fact that in true defensive measures we are late comers, this requested amount is desperately needed.

Then on page 8 you say:

> At this time, the Soviet Union enjoys a monopoly in defensive weapons and also in most of the research leading to such weapons.

AREAS OF U.S. SUPERIORITY OVER SOVIETS

A couple months ago the Under Secretary of Defense for Research reported to Congress on the comparison of the U.S. basic technology in the 20 most basic technological areas relating to the military. Many of them related very closely to SDI.

I want to run through those quickly. They are specific and they seem to challenge your general conclusions.

In the first place, you agree we are superior in computers and software. However, when you get a little further down, you find that we are superior to the Soviet Union in every respect. On electro-optical sensors, the United States is ahead. Guidance and navigation, United States ahead. Thermal light weight, high strength, high temperatures, United States ahead. Microelectronic integrated circuit manufacturing, United States ahead.

Optics, the Soviet Union and the United States are about the same. Power sources, including energy source, the two super powers are about the same. Production manufacturing, including automated circuit control, United States ahead. Propulsion, United States ahead. Radar sensors, United States ahead. Robotics, United States ahead. Signature reduction, United States ahead. Telecommunications, United States. ahead.

There is no area, none, in which the Defense Department who supported SDI told us that the Soviets are superior. None. We are ahead in every one of the areas that are listed. Many of them, you know, are very important to the SDI.

How do you explain your posture which I understand this morning is that we are behind and they are ahead?

Dr. TELLER. Thank you very much for your question. It is an obviously relevant one and for me it is a story that is several decades old.

The Soviets are ahead in all areas, in my opinion, where we can check. Where we observe their deployed missiles, they are ahead in throw weight by a considerable amount. In areas where we cannot check, we are ahead.

Senator PROXMIRE. We do not know if we cannot check it. It is your judgment against the judgment of others?

Dr. TELLER. Sir, that is correct. I would argue for a moment on the side of the Department of Defense with which I do not agree, but I argue on their side. The Soviets are obviously way behind us in their civilian economy.

Is it not just impossible to postulate that they should be ahead in military technology? Of course our sense of values is different.

Also, in the Soviet Union secrecy works. Now, in many of these examples that you cited which are hard to check, where we may be ahead or may not be ahead, we just do not have the information.

There is one very essential point among those that you have cited which is quite relevant to SDI. There I simply and totally disagree with the testimony that you received from the Department of Defense. The Department of Defense states that the Soviets have spent on high-powered lasers at least $1 billion for many years running.

I have known about this development for 10 or 15 years. I had not understood it. I have a number of sources that evaluate their spending at probably $2 or $3 billion a year. Our spending in this area is not yet up to the $1 billion level.

The Department of Defense has published evidence for a deployed high-energy laser system on the shores of Lake Balkash in Siberia and at Sary Shagan. We have nothing like it.

After all these details have been stated, the summary is we are neck and neck. To my mind, to parade my Latin knowledge, this is a non sequitur.

Senator PROXMIRE. Thank you, sir.

My problem is that this is what the Defense Department said, that in 20 of the most important basic technology areas, overall we are ahead in 14, we are tied in 6, and the Soviet Union is ahead in none.

Dr. **Teller**. I agree with the Department of Defense in all areas, if they shifted one notch. When they say we are ahead, the fact is that we are equal. Where they say we are equal, the Soviets are ahead. When they say the Soviets are ahead, the fact is that they are far ahead. And we are ahead in one field only, computers.

Senator **Proxmire**. The Defense Department has always, under every administration, made the Soviet Union 10 feet tall. The President of the United States talked about the great superiority they have in conventional weapon systems and I have never had the Defense Department come in and play down the Soviet strength.

It is a realistic kind, at least it is an understandable kind, of position to assume that your adversary is strong, given the benefit of any doubt. You say it is the reverse, that we have been giving ourselves the benefit of every doubt, and that is a little hard for me to believe.

Let me ask you this question.

Dr. **Teller**. May I comment on this statement I just made?

I had a very good friend, Tom Lamphier. He was a fighter pilot who shot down Admiral Yamamoto. I knew him well. I liked him. I appreciated him. He is one of the main authors of a wrong statement of a missile gap in the 1960's. We are never allowed to forget that.

I did not believe in that missile gap at that time. Tom Lamphier lost his job for advocating the missile gap. It was very hard on him. He went to the President with the missile gap and the President, Eisenhower, got so mad about it that he then and there wrote something about the "military-industrial complex."

Few of our Presidents have properly emphasized the danger of Soviet advantage. Tom Lamphier was almost right. He said there was a missile gap in 1960. He would have been right in 1970.

SURVIVABILITY OF SPACE-BASED SYSTEMS

Senator **Proxmire**. Dr. Teller, you said that space-based defensive systems would face severe survivability problems. In testimony before the Armed Services Committee 3 years ago on May 12, 1983, you said:

> I believe we should not deploy weapons in space and in this sense to talk about Star Wars is an inappropriate description of what the main question is. To put objects in space is expensive. To destroy space objects is easy.

Is it true space-based assets suffer from severe survivability problems and would be too expensive to deploy, in your judgment, still?

Dr. **Teller**. All this is true at the present time. But in the meantime, under the able leadership of General Abrahamson we have deemphasized space deployment. We have put more emphasis on popup systems and we are beginning to put real emphasis on decreasing the cost of deployment in space.

I will not say now that space deployment is ineffective in the future. In the future space deployment might become interesting. In order to observe the launching of rockets, space deployment has great importance and we should expend all the research possible toward making these space assets cost effective. It will not be easy.

EMPHASIS ON GROUND-BASED DEFENSIVE SYSTEMS

Senator PROXMIRE. Dr. Teller, SDI, as I understand you have been saying, has been considering generally two types of architecture here.

One relies heavily on space-based defensive weapons. One relies on ground-based defensive systems which you feel is more realistic.

SDI told us that the ground-based architectures are the dark horse architectures. SDI is not giving up space-based architectures. General Abrahamson told us that space missile defense has to work for Star Wars to work.

Your findings cast some doubt over the military viability of space-based weapons.

Is SDI pursuing space-based defensive systems that you consider basically to be unsound?

Dr. TELLER. General Abrahamson has introduced the word "horse race." He has a good eye for horses, including dark horses. He has strong entries, space-based chemical lasers. He has greatly advanced ground-based free electron lasers.

We are clearly moving in the right direction. I cannot agree with absolutely every detail of a subject which is extremely broad. I may easily be wrong. Others may easily be right.

All I can say is that I do not rule out space-based possibilities in the future. We are moving in the direction of emphasizing ground-based defenses and we are moving in the direction of making space-based deployment less expensive, more survivable.

BATTLE STATIONS IN SPACE

Senator PROXMIRE. As I understand, space-based kinetic kill vehicles would be battle stations in space that would fire rockets at Soviet missiles.

In the May 1985 issue of the Defense Science magazine you wrote:

> To predeploy battle stations in space in which missiles can be shot down is the plan that gave rise to the misnomer Star Wars in which I do not see much hope. I do not say it is impossible. Indeed, ingenious ideas make it possible. That is not the basis on which I am arguing. To put up a battle station is too expensive. To shoot it down is all too easy.

As I am sure you know, the near-term deployment option SDI is purchasing is the space-based kinetic kill vehicle. That is the heart of their operation.

Putting new sums of money for demonstration projects in these battle stations, am I correct in concluding from your Defense Science article you do not see much hope for defense battle stations?

Dr. TELLER. That hope is tied to less expensive deployment in space and, therefore, I would like to see that point emphasized which, in turn, will do a lot to justify some of the past efforts. There, to a somewhat diminishing extent, are still being exercised.

Senator PROXMIRE. Thank you, Mr. Chairman, my time is up. I have no more questions.

Senator STEVENS. Senator Cochran.

Senator COCHRAN. Thank you, Mr. Chairman.

SOVIET VIOLATIONS OF ABM TREATY

Dr. Teller, it is disturbing to me to hear that the Soviets may be as close as you say they are to being able to render our retaliatory capabilities ineffective.

How could they be so close to achieving that goal and still be within the terms of the ABM Treaty?

Dr. TELLER. They are not within the terms of the ABM Treaty in Krasnoyarsk. They are coming close to violating the ABM Treaty when they deploy high-energy lasers in Sary Shagan and in other places.

I believe they are not within the terms of the ABM Treaty and I would like not to see more treaties of that type signed as long as the existing treaties are not observed by the Soviets.

Senator COCHRAN. Some of those who are critical of the research effort of the Strategic Defense Initiative use as a reason for opposing it the fact that it would render obsolete the ABM Treaty or inevitably lead to a breach of that treaty.

In your judgment, is that not a good basis for arguing against the initiative?

Dr. TELLER. It is an excellent argument to argue against what the Soviets have done. It is not a good argument for us to ignore what the Soviets have done.

Senator COCHRAN. You could get the impression, I think, from reading a lot of our news reports here in the United States, that this is an effort that President Reagan dreamed up to do research in defensive capabilities, to try to develop ideas and information about defensive capabilities as an alternative to mutual assured destruction, which is the basis of our current strategic effort.

But from your testimony, it is clear that as much as two decades of work has already been done by the Soviet Union in this area. Is that correct?

Is my understanding of your testimony correct?

Dr. TELLER. That is absolutely correct, at least two decades of intensive effort. In these two decades we did not completely ignore defense, but our efforts were quite negligible compared to what the Soviets have been doing.

When President Reagan was Governor of California, one of his first actions was to visit the Lawrence Livermore National Laboratory. He became informed at that time of our work, small as it was, which later was discontinued. We worked on defensive weapons for the terminal phase.

I am not advisor to the President. My influence has been greatly exaggerated, but I know enough of the details to be aware of the simple fact that President Reagan has given careful thought to the question of defense and our lack of emphasis on defense, for approximately two decades.

His famous speech of March 23, in which he did not mention Stars—Senator Kennedy called it Star Wars—that speech was incomparably more carefully considered than Roosevelt's decision to go ahead with the atomic bomb.

NONNUCLEAR ASPECT OF SDI

Senator COCHRAN. One of the more attractive aspects of this entire effort to me has been the fact that it emphasizes a nonnuclear defensive capability. Just recently it has been reported that some amount of the research is being done with nuclear-directed weapons.

Is that a necessary part of the initiative? Can we look for a change in the effort toward a nuclear defensive effort rather than a nonnuclear defensive effort?

It will make it a lot more difficult to sell to some of us, I tell you that.

Dr. TELLER. Sir, I am sorry to say it is absolutely necessary. Even more is necessary than what we are doing now. Indeed, this is one of my criticisms.

The right statement to make is that we must work to prevent methods of mass destruction, whether they are incendiary bombs, nuclear bombs, or biological warfare.

Senator Proxmire's effort against genocide is absolutely right. To prevent genocide is the core of the problem.

X-RAY LASER

We are working on an x-ray laser. It can be used as a directed-energy weapon. It cannot act on the surface of the Earth. It can be used against rockets in space. For this we need a nuclear explosion, not on the surface of the Earth, but a harmless nuclear explosion which emits a sharp directed beam. The beam is so sharply directed that in 1,000 miles this beam should spread by no more than 5 feet. For this purpose, we need a nuclear initiator.

In the terminal defense of Moscow, and I am afraid in a planned manner in other places in Russia, small nuclear defensive weapons may be used over their own territory.

A nuclear weapon of 100 tons TNT equivalent exploded 2 or 3 miles over your head is completely harmless on the surface of the Earth. In this way reentry is made very much more difficult, defense very much more easy. We have every indication that the Soviets are doing it. We have held back.

I believe that the distinction should not be between nuclear and nonnuclear. The distinction is between defense and mass destruction. That distinction can be made very clearly.

Senator COCHRAN. Thank you very much.

Thank you, Mr. Chairman.

Senator STEVENS. Thank you very much.

Senator Proxmire.

Senator PROXMIRE. Thank you, Mr. Chairman.

NUCLEAR DANGER FROM SPACE-BASED WEAPONS

Dr. Teller, the recent accident at Chernobyl shows how dangerous nuclear reactors can be, particularly in Soviet hands.

If we pursue space-based, direct-energy weapons, we will need enormous power sources in space, hundreds of megawatts, according to SDI. If we do this, the Soviets will follow suit.

Are you confident the Soviets can safely launch and retrieve reactors in space?

Dr. Teller. The power sources on Earth like Chernobyl have very little to do with power in space. The way to get power into space is not esoteric. One can transmit power into space by a high-intensity laser such as the Soviets have already deployed in Sary Shagan in Siberia.

That is the field where they are, according to all concrete evidence, really ahead of us. A very big power installation is not needed. A facility for power storage is needed which is much cheaper, much less conspicuous.

We know how to store power, so do the Soviets. We have to convert that power into a form in which it can be transmitted into space.

TRANSATMOSPHERIC VEHICLE

A second means is the transatmospheric vehicle—a vehicle that can be flown out of the atmosphere—made to dip back into the surface of the atmosphere. This could be done over our own territory. We can transmit power to it in a variety of ways.

Also dipping back into the atmosphere and using the interaction with the atmosphere will make the use of power very much more easy. There are specific ways how to make predeployed vehicles more feasible.

I do not subscribe to everything I said even a year ago, partly because I am learning. There is less emphasis on predeployment and there is more emphasis on ways how to make predeployment possible.

SDI PANEL ON SPACE-BASED SURVIVABILITY

Senator Proxmire. Dr. Teller, I understand that a number of your colleagues recently took part in a space-based survivability panel for SDI. However, it is my understanding that findings of that panel have been collected and will not be published.

What can you tell us about the panel and its findings?

Dr. Teller. I do not know any details.

BUDGET ON SDI RESEARCH

Senator Proxmire. Finally, Dr. Teller, you talked about we have not been spending enough on SDI research. SDI's budget has been tripled since the inception of the program. The 1987 budget request would quintuple the program since its inception.

Would you call that an underfunded program at the time of enormous pressures on the Federal budget?

Dr. TELLER. As compared to the Soviet Union; yes. I believe that we are more clever than the Soviets. We are not that much more clever.

I also know that some of our most clever people use their time and energy in arguing instead of looking and when visitors come for a visit they say, "You have been doing fine. Stop it, lest the Soviets imitate us."

We have the data to show that the Soviets are ahead. Indeed, we are underfunded, and I believe that proper funding of this project is likely to be the key to oppose genocide and to preserve peace.

Senator PROXMIRE. Dr. Teller, we have been told by former Secretaries of Defense of great stature, including Harold Brown whom you know very well and who was head of Livermore Lab and a great physicist as well as a defense expert, that it is not possible for a research program to be expanded at this rate and operate efficiently.

In fact, the general view was that we should have grown at a maybe 30-percent rate which would be very fast in most programs, but to double, triple, quadruple all at once, pouring all these funds in, it seems to this Senator, and I am no expert in any sense of the word in this area, but it seems to me that the funds are enough, but maybe they are not spending them in the right way or in the right places.

Dr. TELLER. Harold Brown is a good friend. I must tell you, Senator, I must ask for your indulgence to listen to a short story about Harold Brown.

I was Director of Livermore. He was in charge of designing nuclear explosives. The two of us from Livermore participated in a planning session at Nobska for the Navy to get an element of man and I said that at a certain date early in the 1960's we will have a megaton explosive that will fit into a submarine. That statement helped to get our submarine program started.

At the end of this conference I caught hell from Harold Brown. "You promised what we cannot possibly deliver."

He had a point because he was head of that division which was to deliver. He complained that I had overpromised.

Harold Brown delivered more than a megaton ahead of schedule.

Senator STEVENS. Any further questions?

You are really tops, Dr. Teller. We appreciate your taking the time to be with us and give us a chance to visit with you concerning the funding levels for SDI.

You have made a very strong presentation to us. We appreciate your continued dedication to our country's defense. Thank you very much.

SCIENCE AND ENGINEERING COMMITTEE FOR A SECURE WORLD

STATEMENT OF MARTIN J. HOFFERT, REPRESENTING SCIENCE AND ENGINEERING COMMITTEE FOR A SECURE WORLD

BIOGRAPHICAL SKETCH

Senator STEVENS. We will now have a statement by Dr. Martin Hoffert representing the Science and Engineering Committee for a Secure World.

It is my understanding this is the first appearance of this Committee to make a statement publicly concerning their goals. We welcome you here. I appreciate your time.

[The bibliograph of Mr. Hoffert follows:]

BIBLIOGRAPHY OF DR. MARTIN HOFFERT

Dr. Martin I. Hoffert received his Ph.D. in astronautics in 1967 from the Polytechnic Institute of Brooklyn. In 1968 he received an M.A. in liberal studies from the New School for Social Research in New York.

He is professor and chairman of the department of applied science at New York University. He also served as a senior research associate at the NASA Goddard Institute, where he did work on space science and atmospheric physics, and at the Riverside Research Institute, where he conducted studies of ballistic missile defense. He has been principal investigator on a number of research grants from the Department of Energy, the National Aeronautics and Space Administration, and the National Space Foundation, and was recently appointed to a NASA advisory committee on planetary atmospheres.

He is an accomplished writer in many scientific fields, having published about 60 papers in the areas of space, energy conversion, planetary science, and environmental studies.

PLANET SURVIVAL

Dr. HOFFERT. Mr. Chairman and distinguished members of the committee, it is a pleasure and an honor to be here today to discuss an issue of major significance to the survival of our planet.

I must say that Professor Teller is a tough act to follow. I do appreciate the opportunity to make these comments, however. I want to express my organization's appreciation for the opportunity to present our views.

SUPPORT FOR SDI RESEARCH PROGRAM

The Science and Engineering Committee for a Secure World is a recently formed group of distinguished scientists and engineers, about 80 in number now, but certain to increase significantly in the future, who strongly endorse the Strategic Defense Initiative research and development program.

This is our first public appearance. We are confident that there are thousands of scientists and engineers across America and elsewhere who agree with us that it is unscientific and unwise to hastily oppose the promising Strategic Defense Initiative proposal at this early stage of its research and development, and who believe that the concept of developing a defensive system to protect our people from a nuclear attack makes good common and good moral sense.

Our acting chairman is Dr. Fred Seitz, former president of the National Academy of Sciences and president emeritus of Rockefeller University, who sends his regrets that another obligation has prevented him from appearing here today.

The committee will actively work to inform the media and the public about the nature and importance of the Strategic Defense Initiative for America's future peace and security.

POLICY STATEMENT ON SDI

I will now present to you the committee's policy statement on SDI.

At present the American people, by past Government policy and to some extent by previous limitations of science and technology, have essentially no defense whatsoever against a nuclear missile attack or even a single accidental launch. The United States can only respond to an approaching Soviet first strike by killing millions of Soviet citizens in revenge, or by doing nothing.

MAD DOCTRINE

Not only America, but the whole world lives with the fear and insecurity caused by the unstable balance of nuclear terror. This balance rests on the premise that both the United States and the Soviet Union follow the controversial doctrine of mutually assured destruction [MAD]—a doctrine rendered increasingly obsolete by powerful new Soviet missiles and technological advances on both sides.

The genious of American scientific and engineering professionals helped, however well meaning, create this world of nuclear terror. But today scientists and engineers from America and around the world have the opportunity to play a positive and critically important part in reducing and perhaps eventually eliminating the threat of nuclear war by means of America's Strategic Defense Initiative Program.

As professionals trained in scientific methodology, we believe that the feasibility of a promising scientific or technical proposal should not be judged in advance of proper research, experimentation, and testing.

Therefore, we believe that the Strategic Defense Initiative should not be hastily, unscientifically, or ideologically rejected without this necessary thorough evaluation to determine its feasibility, its effectiveness, and its practicality—which is the very purpose of the SDI Program.

Indeed, we ask our fellow scientists and engineers, is it not our responsibility as professionals and as concerned human beings to utilize our talents and energies now to see if we can render the nuclear threat militarily ineffective and, therefore, obsolete?

METHODS FOR NEUTRALIZING NUCLEAR THREAT

New technological breakthroughs have significantly increased the prospect that the United States can successfully devise effective systems which will destroy attacking Soviet nuclear missiles long before they can come close to their targets in America, Europe, or elsewhere.

Included are such things as electronic miniaturization, super computers, infrared sensors, rubber mirrors, greatly enhanced laser beam power, the scramjet concept, and optical synthetic aperture imaging.

These and other recent scientific and engineering achievements are providing the world with the possibility that the nuclear superpowers can move away from reliance on the threat of using nuclear weapons designed for the mass destruction of humanity in order to maintain security, and instead to reliance on defensive weapons designed to increase stability in periods of crisis, to protect countries from attack, and to save lives.

STRATEGY OF SDI

The Strategic Defense Initiative undertaken by President Reagan and the Congress seeks to utilize such new technological means to turn America's strategic military policy away from the unreliable, outdated MAD doctrine and its death-dealing nuclear missiles, to a mutually assured survival policy based on new, life-protecting defensive systems.

As such, SDI embodies a strategy surely ethically superior to the MAD policy, as well as a concept of strategic deterrence that is very likely more sound from a military standpoint.

By developing the defensive means to shoot down Soviet—or other—nuclear missiles or warheads in space or the atmosphere before they explode on Earth, SDI is intended to significantly increase America's deterrence to a Soviet nuclear attack, as well as to eliminate the danger from an accidental launch.

Even a less than 100-percent perfect defense system could nonetheless render an attack militarily ineffective, and, therefore, greatly reduce the probability that an attack would ever be launched in the first place. In the quite unlikely event that an attack did occur, strategic defenses would tremendously reduce the loss of life and damage that would otherwise result without any such defense system in place.

In addition, the technology being developed by the SDI Program could also readily be utilized to help provide successful defenses against bombers and cruise missiles, as well as shorter range nuclear missiles.

SDI is not designed to cause a war in the heavens, as some charge, but to prevent nuclear war on Earth. It would not lead to the militarization of space, which was already militarized by the first Sputnik satellite and the first ICBM. Instead, SDI is intended to render space and the atmosphere militarily useless for nuclear missiles—to stop nuclear weapons in space so they cannot hit the Earth.

SOVIET UNION EFFORTS IN STRATEGIC DEFENSE SYSTEMS

The fact that the Soviet Union began serious research, development, and testing of advanced strategic defense systems some 10 years before the United States, and is continuing to expand its offensive nuclear capabilities, makes the Strategic Defense Initiative more accurately a response to this Soviet effort and buildup.

Furthermore, even without additional technological advances on its part, growing evidence indicates that the Soviet Union is producing the capability, in violation of the ABY Treaty, to rapidly deploy a nonexotic strategic defense system of antiballistic missile [ABM] missiles.

This defense system could be effective against a ragged United States retaliation in response to a Soviet first strike on United States nuclear weapons. It is estimated that the Soviet Union could deploy such a system by the early 1990's or sooner, regardless of whether the United States proceeds with its SDI—see "Soviet Strategic Defense Programs," Departments of State and Defense, October 1985, et cetera.

Such a development could significantly enhance the Soviet Union's nuclear blackmail capability and tempt it in very dangerous new ways.

ARGUMENTS FOR U.S. EFFORTS TOWARD SDI

These developments make the case for America's SDI effort an even more compelling one. Indeed, it can be argued that it is imperative for America's continued security and for world peace that the SDI research and development program proceed with all deliberate speed.

At the same time, we believe that in the long run the most realistic and best path toward international stability, better United States-Soviet relations, and world peace is likely to be found in the United States and the Soviet Union engaging in a mutual transition from offensive strategic weapons to defensive ones, aimed at the flight corridors of potentially approaching nuclear weapons, rather than at human beings.

Such a change in policy would vastly increase real security for both countries and, therefore, considerably reduce fear and mistrust on both sides.

For the above reasons, therefore, it is our judgment that the Strategic Defense Initiative Program is worth pursuing and deserves the full support of the scientific community, Congress, and the American people.

Under the less restrictive interpretation of the ABM Treaty of 1972 which the U.S. Government has stated is the correct one, the necessary testing of potential defensive systems can and should be done so that Congress has the required information about the effectiveness of particular systems in order to make a sound decision concerning eventual deployment.

NEGOTIATIONS ON NEW ABM TREATY

If strategic defenses prove to be feasible and practical after careful testing and assessment of costs and effectiveness—particularly in relation to possible Soviet counteractions—and in light of Soviet SDI programs, we recommend that a new ABM Treaty be negotiated which embraces strategic defenses, and also equitable, verifiable reductions in offensive nuclear weapons.

Such a treaty should encourage mutual deployment of defensive systems so that the era of mutually assured survival, instead of destruction, can be ushered in cooperatively.

In the absence of Soviet agreement to such a new treaty, and in view of the extensive Soviet work on advanced strategic defenses and Soviet violations of the current treaty, United States withdrawal from the treaty—in the supreme interests of the American people, as provided for by use of the terms of the treaty itself—and deployment of its own strategic defenses should be seriously evaluated.

Unilateral U.S. compliance with the existing treaty would serve neither America's interests nor the world's.

In conclusion, as professional scientists and engineers, we want to express our earnest hope that history will record that in our day America's and the world's best scientific and technical minds sought to develop the technology which helped humanity move back from the nuclear precipice—and succeeded. We can do no less.

[The bibliography of the Science and Engineering Committee for a Secure World follows:]

Science and Engineering Committee for a Secure World

ANNOUNCING THE

SCIENCE AND ENGINEERING COMMITTEE FOR A SECURE WORLD

The Committee was formed in support of the Strategic Defense Initiative program to develop effective, deterring protection from a nuclear attack for the U.S. and its allies. It was recently established (May '86), with some 80 scientists and engineers as founding members. (See attached list).

It will seek to inform the public about the Strategic Defense Initiative and will undertake the following effort:

1) Demonstrate to the public that there is significant support for SDI from informed, respected and articulate scientists and engineers.

2) Establish a responsible academic, scientific and engineering base of support for the Strategic Defense Initiative program.

3) Maintain contact with and supply information to the media relating to SDI and our activities.

4) Provide the media and others with a timely source of interviews and speakers concerning SDI and related issues.

5) Communicate with fellow scientists, engineers and science and engineering groups, etc. on a regular basis.

6) Sponsor factual reports and professional conferences concerning SDI and related issues.

7) Prepare and publish critiques of materials by opponents of SDI in terms of errors, omissions, bias, faulty reasoning, etc.

Dr. Fred Seitz, former president of the National Academy of Sciences and president emeritus of Rockefeller University, is the acting chairman of the group.

Listing of the Founding Members of the Science and Engineering Committee for a Secure World: (organizations listed for identification only)

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SUPPORT OF SCIENTIFIC COMMUNITY FOR SDI

Dr. HOFFERT. I would, after reading the statement of our organization, like to make some very brief comments which are my own views regarding the SDI program.

It is my feeling that there is considerable support for the SDI Program within the academic community, much more than is generally conveyed by impressions one gets from the media.

I believe—and again speaking for myself rather than the committee as a whole—that the component of the SDI Program, which is rather small, of the order of 2 or 3 percent of the SDI, going into the SDIO—the university-oriented component of the program—is extremely important because it encourages the participation of the innovative young scientists in the spirit of Dr. Teller's remarks.

I also believe it is very important that at least that component of the program retain an unclassified flavor which would make it possible for university scientists to participate and that the Strategic Defense Initiative Office and the Office of Innovative Science and Technology be given every opportunity and every facility they may require to interact more effectively with university and academic scientists.

This is not an issue which requires an enormous amount of money. We are talking about relatively small components of the program. I believe it is one which would pay very, very great dividends to the program as a whole.

Most scientists and engineers recognize that technological innovation generally comes relatively early in one's academic career.

I think it is very vital that we have an opportunity to involve young people, our graduate students, many of whom have read about SDI and are very interested in the program and in actually getting involved in that research, themselves, and have the ability to discuss it with their colleagues and with their peers, and ultimately to have the results of this research published in reputable scientific journals under the peer review process.

This is very much in line with what Professor Teller has said. It seems to me it really should be implemented. Again, as I say, those are basically my views, but as far as our committee in general, I think what our movement does illustrate is that there is a growing body of support among a broad spectrum of scientists of different political views, I might add, in support of the type of research that could lead to a fundamental change in the nature of strategic defense.

Innovative technology, as we all know, has totally transformed our lives and continues to transform our society. Accordingly, we should make every effort to transform our present offensive nuclear deterrent approach to a more humane one of defensive deterrence, and to seek such solutions from the most promising sources of technological innovation.

Thank you.

Senator STEVENS. Thank you very much.

INVOLVEMENT OF UNIVERSITY STUDENTS IN SDI PROGRAM

I am reminded of an argument, a discussion really, that I had with another Member of the Senate last year about SDI. He raised the question of the extent of university students' involvement in view of the high degree of foreign student participation in our graduate studies in this country.

He was questioning me about the classification portion, the portions of SDI that were classified.

Do you see any problem concerning this level of participation of foreign students?

The last statistics I had showed that approaching 50 percent of our graudate students in our universities were foreign students who had no intention of maintaining U.S. residence.

Dr. HOFFERT. What you bring up is a well-known problem. It is recognized that American students are not as motivated to pursue scientific and engineering careers as they were in the past. Part of it has to do with very high starting salaries for bachelor degree engineers relative to starting salaries of assistant professors who would be getting Ph.D.'s.

It is a problem that has to be addressed. I do not know that the SDI Program will solve that. What we could address is the problem of supporting graduate students and the types of dissertations and research that they would be becoming trained in.

My own personal experience, which is somewhat anecdotal, is that there is a very, very high degree of interest in SDI, some of it positive and some of it negative. I find the basic problem is that the level of debate on SDI in academia is abysmally low. I think that is because the kind of scientific peer review that normally goes on in other scientific areas has really largely been absent in the SDI Program.

Senator STEVENS. Because of classification?

Dr. HOFFERT. I think in part because of classification; yes. It becomes very difficult to have a rational and objective assessment without open publication, and very easily you can get degeneration into rhetoric that is not the normal scientific mode.

I do not think it is in the interest of the country to have debate at that level. One way to avoid that would be to invest the level of support of not only financially, but, so to speak, spiritually and encourage the participation of university scientists and their students.

SDI FUNDING

Senator STEVENS. Dr. Teller made a point about the necessity for continued increase in the expenditures in order to attract the best of our young students.

Is the level of funding important or is it the support that is indicated by a constant increase in funding or is it the amount of increase that is important?

Dr. HOFFERT. It seems to me the critical thing is that when you are trying to attract new people into a program, you are not going to get them through zero-based budgeting. Under ordinary circumstances, a program manager will have a program supporting certain groups. If you come in with an innovative idea, unless he or she has an increase in their program, they are not going to be able to support it.

The problems that we are talking about are very challenging and very difficult. It seems to me they are precisely the kinds of problems that require a kind of synthetic approach and very innovative approach that could be fostered by universities.

In order to do that, the program manager has to be able to take a risk and to support a new type of research which he might be reluctant to do in a program that is locked into zero budgeting.

Senator STEVENS. I want to congratulate you and your colleagues for forming this new Committee for a Secure World and the emphasis you place on the defensive side of our military capabilities.

SOVIET PROGRESS IN SDI DEVELOPMENT

You made the comment about the Soviet Union's serious research development and testing of SDI systems some 10 years before we initiated ours. That has been a difficulty for those of us who support SDI.

I remember asking General Abrahamson if we could use the information concerning the Soviet publication of the application of radio wave technology in the late 1960's and we did retrieve that and have made use of it in various debates in forums, but that is an isolated instance.

Could your committee assist us in trying to bring out of the mass of documentation in this area some examples of the results of Soviet research in the past, like that radio wave article?

I think you may be familiar with that.

HIGH-POWERED EXCIMER LASERS

Dr. HOFFERT. I can give you an example right now out of my own personal experience in researching the subject, myself, of the high-powered excimer lasers.

I went through the normal process of doing literature searches. As I discovered the key articles on high-powered excimer lasers were published in the Soviet Journal of Quantam Electronics, a Russian journal translated in the United States, I think extending from the 1970's to the early 1980's.

There were few publications after that. It was very clear from this published literature that high-powered lasers have been a major priority in the U.S.S.R. I could make this work available to you if you want to see it. It is interesting the way the papers are written. The Soviet authors began the papers by implying there are some very important applications of high-powered excimer lasers with the implication they might have some industrial applicability without specifying what the applicability was.

However, when we developed at NYU a related concept of excimer lasers and tried to patent it, the patent attorney informed us there did not seem to be any apparent nonmilitary application for a very high-powered excimer laser. He did not think it was worth pursuing the patent for that reason.

The implications of this Soviet work are now evident, but were not always so. It seems, as Professor Teller pointed out, not many people were clear on why this emphasis of research was going on, but it is definitely in their own literature.

Senator STEVENS. I had a long discussion with one of the editors of one of the leading newspapers of the country and made the statement that you have made that I believe the Soviets were involved a good 10 years before we started our SDI and was challenged on it.

The only thing I could pull out to prove that was that radio wave article.

Dr. HOFFERT. We can make that information available to you.

CLASSIFICATION OF SOVIET PUBLISHED MATERIAL

Senator STEVENS. That would be very helpful to us. I think that is the kind of thing your people could be of great assistance to us on because, by definition, we have to be using information that is not classified.

I still do not understand why we would classify information that came from the Soviet Union that was published in the Soviet Union in the seventies, but it suddenly becomes classified in the United States in the eighties. It is a crazy system of classification.

Anything you can do to help us, we would appreciate it. I think we will do our best to make certain that the Senate and the Congress knows of the formation of your committee and would welcome the opportunity to work with you to assist you in your efforts to better inform the university community of the SDI Program and what it is doing. We would welcome your comments as we go along.

I note that Dr. Teller is a member of your committee and several others that have appeared before our committee. We look forward to working with you.

We do thank you for coming.

SUBCOMMITTEE RECESS

Our subcommittee now stands in recess until Thursday, May 15, when we will reconvene to receive testimony on AIDS, policy, testing, and research in the Department of Defense.

[Whereupon, at 11:40 a.m., Friday, May 9, the subcommittee was recessed, to reconvene at 10 a.m., Thursday, May 15, 1986.]

LIST OF WITNESSES, COMMUNICATIONS, AND PREPARED STATEMENTS

Page

Abrahamson, Lt. Gen. James, Director, Strategic Defense Initiative Organization 1, 61
  Prepared statements 19, 64

Baciocco, Vice Adm. Albert J., Jr., Director, Research, Development, and Acquisition, prepared statement 232
Brown, Hon. Harold, former Secretary of Defense 141

Chiles, Hon. Lawton, U.S. Senator from Florida, prepared statement 63
Cooper, Hon. Thomas E., Assistant Secretary of the Air Force (Research, Development, and Logistics) 234
  Acquisition statement 246
  Biographical sketch 251
  Executive summary 247
  Joint prepared statement 241

D'Amato, Hon. Alfonse, U.S. Senator from New York, prepared statements 3, 62, 208, 266
Darr, James, Director, Procurement Budget Division, Naval Air Systems Command 185

Hoffert, Martin J., representing Science and Engineering Committee for a Secure World 313
Huling, Capt. John M., USN, Head, Nuclear Negotiations Branch, Strategic and Theater Nuclear Warfare Division, Office of the Chief of Naval Operations 227

Martin, Vice Adm. E.H., USN, Deputy Chief of Naval Operations for Air Warfare 185
  Prepared statement 193
McNamara, Hon. Robert S., former Secretary of Defense 113
  Comments on buildup of Soviet Strategic Forces 135
Miley, Rear Adm. Kenneth C., USN, Director, Strategic Systems Programs, Department of the Navy 227

Paisley, Hon. Melvin R., Assistant Secretary of the Navy (Research, Engineering, and Systems) 227
  Biographical sketch 231
  Prepared statement 229

Randolph, Lt. Gen. Bernard P., USAF, Deputy Chief of Staff (Research, Development, and Acquisition) 234
  Acquisition statement 246
  Biographical sketch 252
  Executive summary 247
  Joint prepared statement 241

Smith, Lt. Gen. Keith A., USMC, Deputy Chief of Staff for Aviation Headquarters, USMC 185, 196
  Biographical sketch 202
  Prepared statement 198

Page

Stevens, Hon. Ted, U.S. Senator from Alaska, opening prepared remarks ... 61

Teller, Dr. Edward, senior research fellow, Stanford University's Hoover Institution; associate director emeritus, Lawrence Livermore National Laboratory; and member, White House Science Council ... 291
  Prepared statement ... 296

Welber, Irwin, president, Sandia National Laboratories, letter from ... 98
Wilkinson, Vice Adm. J.B., USN, Commander, Naval Air Systems Command ... 185

SUBJECT INDEX

NAVY AIRCRAFT PROCUREMENT AND RELATED RESEARCH AND DEVELOPMENT

Page

A–6 attack aircraft 205, 214
  Successor to 213
A–6E/A–6F program 208, 214
  Modifications of 209
Acquisition strategy and policy 189
Aircraft:
  Aging 207
  Purchases 185, 206
  Spares and repair parts 224
Air-launched weapons 190
Aviation safety program 191
Budget request 185
Carrier force 187
  Best aircraft for 207
Competition and dual sourcing 210
D'Amato, Hon. Alfonse, U.S. Senator from New York, questions submitted by 225
Defense acquisition policies 220
Duplicate air forces, reduction of 222
F/A–18 210, 212, 217, 225
F–18 Hornet 188, 205
Force manning 220
Interservice cooperation 191
Kasten, Hon. Robert, U.S. Senator from Wisconsin, questions submitted by 224
Libya, military operation in 203, 213
Major procurement 191
Marine Corps:
  A–6F program 200
  AH–1W helicopter 201
  AV–8B 197, 199, 217
  CH–53E helicopter 200
  F/A–18 196, 200, 210
  Flying hour program 198
  Improved direct air support center [IDASC] 201
  Preparedness 196, 198
  Readiness and sustainability 196
  Reserve Marine forces 201
  Safety 196, 198
  Tactical air operations module [TAOM] 201
  V–22 development program 199, 204, 211, 221
Modernization program 190
Naval aviation overview and program 186
Naval Reserves 190
P–3C retrofit 218
P–3D upgrade 218
Procurement program 193
  Underfunding of 216
Readiness 189, 194

Page
Reserve aviation 225
Sequestration cuts, impact of 215
SH-2F helicopter procurement 224
600-ship Navy 186, 193
Stennis, Hon. John C., U.S. Senator from Mississippi, questions submitted by 225
Stevens, Hon. Ted, U.S. Senator from Alaska, questions submitted by 224
V-22 Osprey 195, 199, 204, 211, 221

STRATEGIC DEFENSE INTIATIVE

ABM system development 125
ABM Treaty negotiations 316
Administration position on SDI, support for 47
Administration strategic policy 118
Aircraft turrets 91
Allied support for 293
Apollo research program 41
Arms control negotiations 40, 119, 124
Ballistic missile defense system:
  Architectures, points of major importance on 23
  Point defense BMD 40
Bargaining chip, status of 127
Battle management/command, control, and communications [BM/C^3] 78
Beryllium, value to SDI program 106
Boost surveillance system 10, 89
Brown, Harold, record as Secretary of Defense 114
  Articles by 146, 155
Budget request 1, 22, 46, 123, 140, 293, 303
Business and university research efforts toward 49
Capability stepup 11
Chemical lasers 171
Communication links 13
Computer requirements 294
Cost goals on key elements of 38
Cost parameters 129, 292
D'Amato, Hon. Alfonse, U.S. Senator from New York, questions submitted by 107
Decoys, use of 11, 93, 101
Defense systems, cost-effectiveness of 44
Deployment, questions of 141
Directed energy weapons [DEW] technology program 70, 94
End-to-end experiment 91
F-16 aircraft 12
Feasibility of 30, 37
Fletcher report 99, 103
Formation of 1
Free electron laser technology [FEL] 27, 33, 95
Fund transfers 80
GAO report, classification of 4, 33
Geneva negotiations 84, 121, 303
Ground-basing 308
Head-on missile 41
Hearing procedure 2
High-powered excimer lasers 323
Homing overlay intercept 31, 97
Independent think tank, recommendations for 50
Indiscriminate satellite destruction, defense against 35
Infrared surveillance 11
Johnston, Hon. J. Bennett, U.S. Senator from Louisiana, questions submitted by 57
Kinetic energy weapons [KEW] program 36, 74, 97, 102, 175

Page

Laser concepts:
  Ground-based 15
  Space-based kinetic kill vehicle 16
Layers of invulnerability 54
Livermore research program 174
Long-term research program, opposition to 42
Manned orbiting laboratory 56
McClure, Hon. James A., U.S. Senator from Idaho, questions submitted by 106
McNamara, Robert S., record as former Secretary of Defense 114
Minuteman silos, defense of 126
Mutually assured destruction [MAD], SDI alternative to 48, 314
Neutral particle beam 11
Nonnuclear kill mechanisms 8
Nuclear strategic warheads, deep cuts in 120
Nuclear submarine capabilities 118
Offensive arms limitation 120
Operational requirement 10
Orbiting vehicle, defense of 177
Plane adjunct 31
Policy statement on 314
Pop-up x-ray laser 36
Program goals and objectives 19, 64
  Accomplishments 69, 73, 75, 77, 79
  Criticisms of 29
  Execution date of 21
  Outlays for 87
  Overselling of 34, 176
  Priorities 32, 88
Proxmire, Hon. William, U.S. Senator from Wisconsin:
  Opening statement of 4
  Questions submitted by 182
Purposes behind 297
Radar optical measurements 90
Research and development program 142, 180, 313
Research funding for 52, 121, 133, 311
Rocket development 294
Sasser, Hon. James, U.S. Senator from Tennessee, questions submitted by 110
Satellite development program 12
Schedule slippage 178
Science and Engineering Committee for a Secure World, list of members for 318
Scientific community, support for 321
Scientist/salesman gap 173
Scowcroft Commission 117
Secrecy, problems with 295, 304
Sensor testing and development 12, 46
Sequester order, effect on SDI from 48
SF-16 aircraft 99
Shuttle fleet, status of 51
Soviet strategic forces, comments of Robert McNamara on buildup of 135
Soviet Union:
  ABM treaties, violations of 43, 309
  First-strike scenario 116
  Ground-based laser development 171
  Krasnoyarsk radar 44
  Nuclear warheads, penetrability of 132
  Offensive systems, development in 20
  Open mass production lines 43
  Published material, classification of 324
  SDI information given to 85
  SDI program 103, 315, 323
  Space-based systems, research into 180

Soviet Union—Continued Page
  Strategic defense area, capability in 131, 298
  U.S. SDI program, concern over 45, 179
Space:
  Basing 305, 307
  Battle stations in 308
  Militarization 304
  Observation 294
Specific impulse 83
Star Wars I and II 118, 126, 130
Stennis, Hon. John C., U.S. Senator from Mississippi, questions submitted by 108
Strategic nuclear policy, objectives of 141, 315
Successful results of, time frame on 39
Surveillance, acquisition, tracking, and kill assessment [SATKA] program 68, 90, 294
Survivability, lethality, and key technologies [SLKT] program 71
System cost reductions 10
System development date, delay of 55
Systems analysis and battle management [SA/BM] 76
Technology of 38, 53
Third-generation weapons 81
Transatmospheric vehicle 295, 311
U.S. lead in specific SDI areas 104, 305
United States/Soviet military capability 115
University students involvement in 322
Vugraph presentation 6
  Fiscal 1986 budget (Vugraph 4) 17
  Fiscal 1987 budget (Vugraph 5) 18
  Radar frequency for terminal imaging radar (Vugraph 3) 14
  SDI objectives (Vugraph 1) 7
  Surveillance investment (Vugraph 2) 9
Warhead survivability 142
X-ray laser 80, 82, 293, 303, 310

STRATEGIC PROGRAMS

AIR FORCE

Acquisition statement 246
Air defense initiative 255, 264, 269, 276
ALCM-carrying B-52 bombers 257
Antisatellite program 239
ASAT missile cost 239, 244, 279, 286
ATB bomber 244, 263, 272
B-1B bomber 243, 271, 285, 287
B-1A/B-1B similarities 256
Basing technology program 236
Bomber modernization program 237
Budget request 227
C-3 network modernization 235
C-17 transport 275
D-5 program 254, 280, 285
D'Amato, Hon. Alfonse, U.S. Senator from New York, questions submitted by 285
Defense support program 244
DSP satellites 288
Executive summary 247
GAO report 240
Ground wave emergency network 253
Land-based ICBM's 241
Manned bombers 243
Midgetman missile 259, 280
Mitzer test 282
MX missile 263, 268, 277, 279

Page
Operational space systems 239
Peacekeeper program 235, 241
Rails and highways, shipment of nuclear materials on 259
Satellite purchase 238
Small ICBM program 235, 242
Stealth bomber 272
Stennis, Hon. John C., U.S. Senator from Mississippi, questions submitted by 285
Strategic:
  Defense architecture 2000 256, 264
  Defense forces 244
  Modernization program 234
Strategic Defense Initiative 273
Superhardened silos 236
Three-warhead, 70,000-pound missile 270
TRIAD, ICBM leg of 235, 263
Unratified treaties, observance of 258

NAVY

Aircraft programs 230
Budget request 227
CBO savings estimate 262
D-5 program 254, 280, 285
D'Amato, Hon. Alfonse, U.S. Senator from New York, questions submitted by 285
Funding changes 259
Guidance systems, funding for 260
Minuteman launchers, dismantling of 266
MX missile 263, 268
RDT&E program 229
SDI program 231
Stennis, Hon. John C., U.S. Senator from Mississippi, questions submitted by 285
Strategic:
  Communications 232
  Missile submarines 229
  Programs 229, 232
Strategic Defense Initiative 273
Submarine programs 230
Test program missiles, reduction in 261
Trident II missile 254, 261
V-22 Osprey 283

O